ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

OCTOBER 1952

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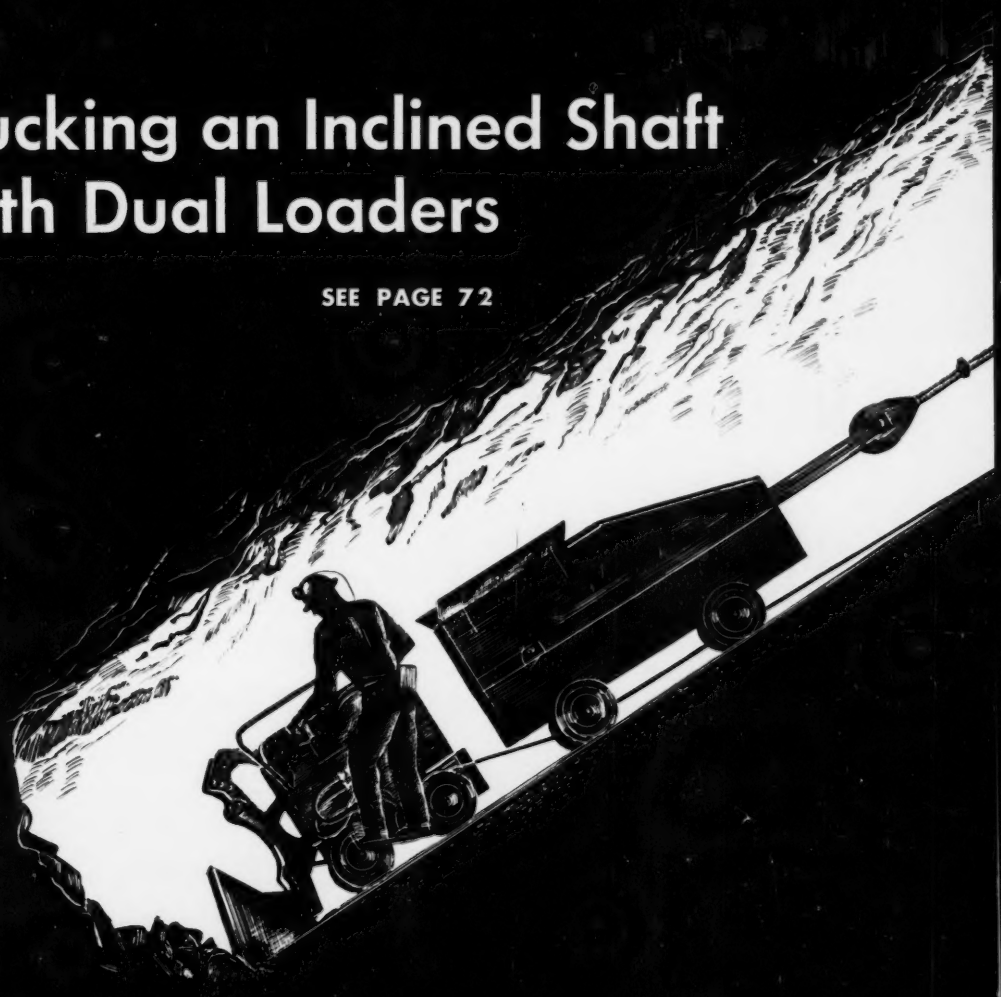
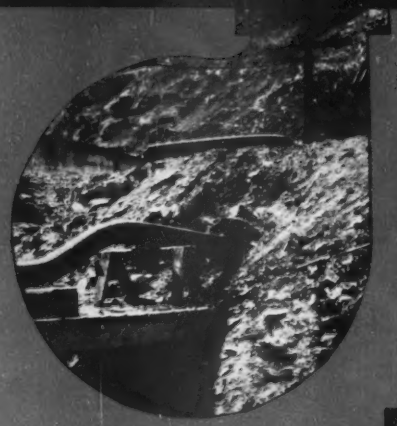
FOUNDED 1866

Mucking an Inclined Shaft With Dual Loaders

SEE PAGE 72





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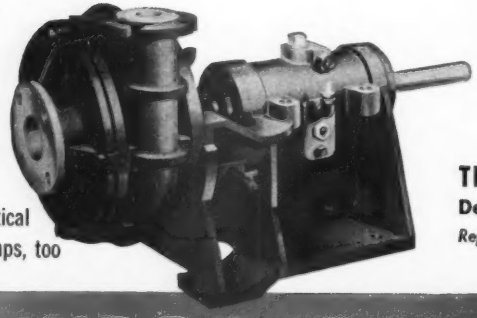

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look at these features:

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3. The quiet, smooth-running, helical, stub tooth gears are made of special heat-treated steel and operate in a bath of grease.
4. High quality seals prevent the loss of grease and the entrance of dirt from all gearing.
5. All rotating parts are supported on ball bearings reducing friction, conserving power and insuring long life.
6. Each drum is equipped with rope guides to prevent excessive wear on the wire rope, individual finger tip clutch control, and external easily accessible clutch adjusting screw.

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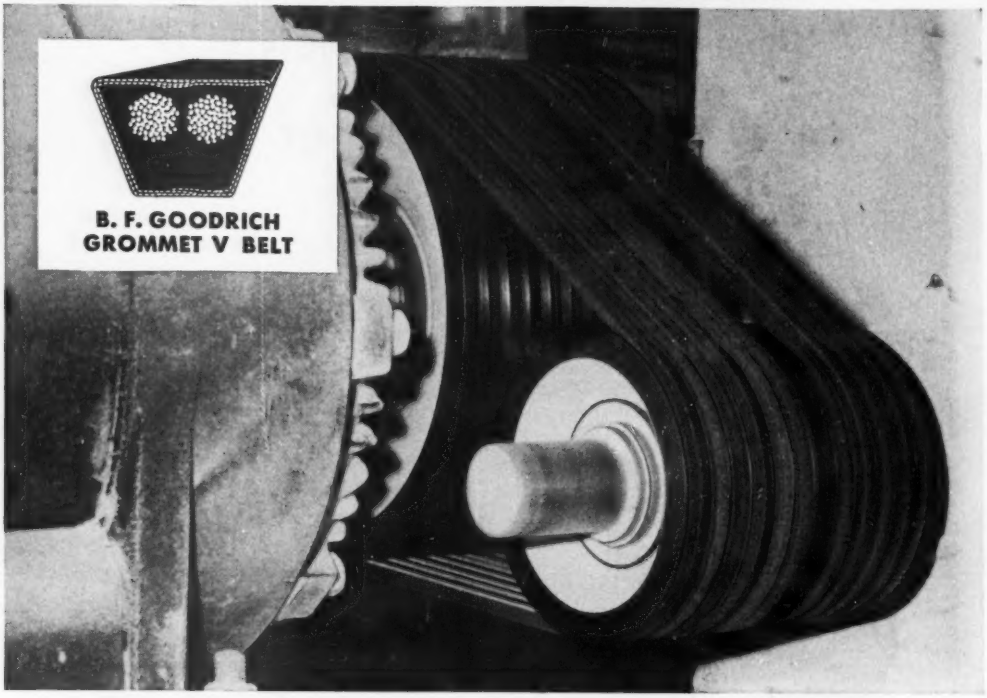
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Where B.F.Goodrich grommet belts outlasted others 3 to 1

B.F.Goodrich grommet V belts cut costs 20 to 50%

ORDINARY belts, previously used on this drive, couldn't stand the heavy load, couldn't take the strain of 24-hour-a-day service. There were frequent shutdowns for repairs. Belts were averaging only 3 months' life. Then B.F.Goodrich grommet V belts were installed. When the picture was taken, the grommet belts had already outlasted ordinary belts 3 to 1, maintenance costs had been cut nearly 100%, and the belts still looked good for a lot more service. Here's why:

No cord ends — A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength — All of the cord material in a B.F.Goodrich grommet belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. There are no layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced. And grommet V belts stretch less — only ⅓ as much, on an average, as ordinary V belts.

Better grip, less slip — Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

They cost no more — Grommet V belts cut costs because they last longer, increase production because machines keep running with fewer interruptions, reduce maintenance costs because they need less attention, yet they cost not one cent more. Available in C, D, and E sections. But remember, only B.F.Goodrich makes the grommet V belt (U. S. Patent No. 2,233,294), so to get all these savings, call in your local BFG distributor the next time you need V belts, or write *The B.F.Goodrich Company, Industrial & General Products Div., Akron, Ohio.* (Available in Canada)

Grommet V-Belts BY
B.F.Goodrich
FIRST IN RUBBER

ENGINEERING AND MINING JOURNAL

VOLUME 153 — 86th YEAR OF PUBLICATION — NUMBER 10

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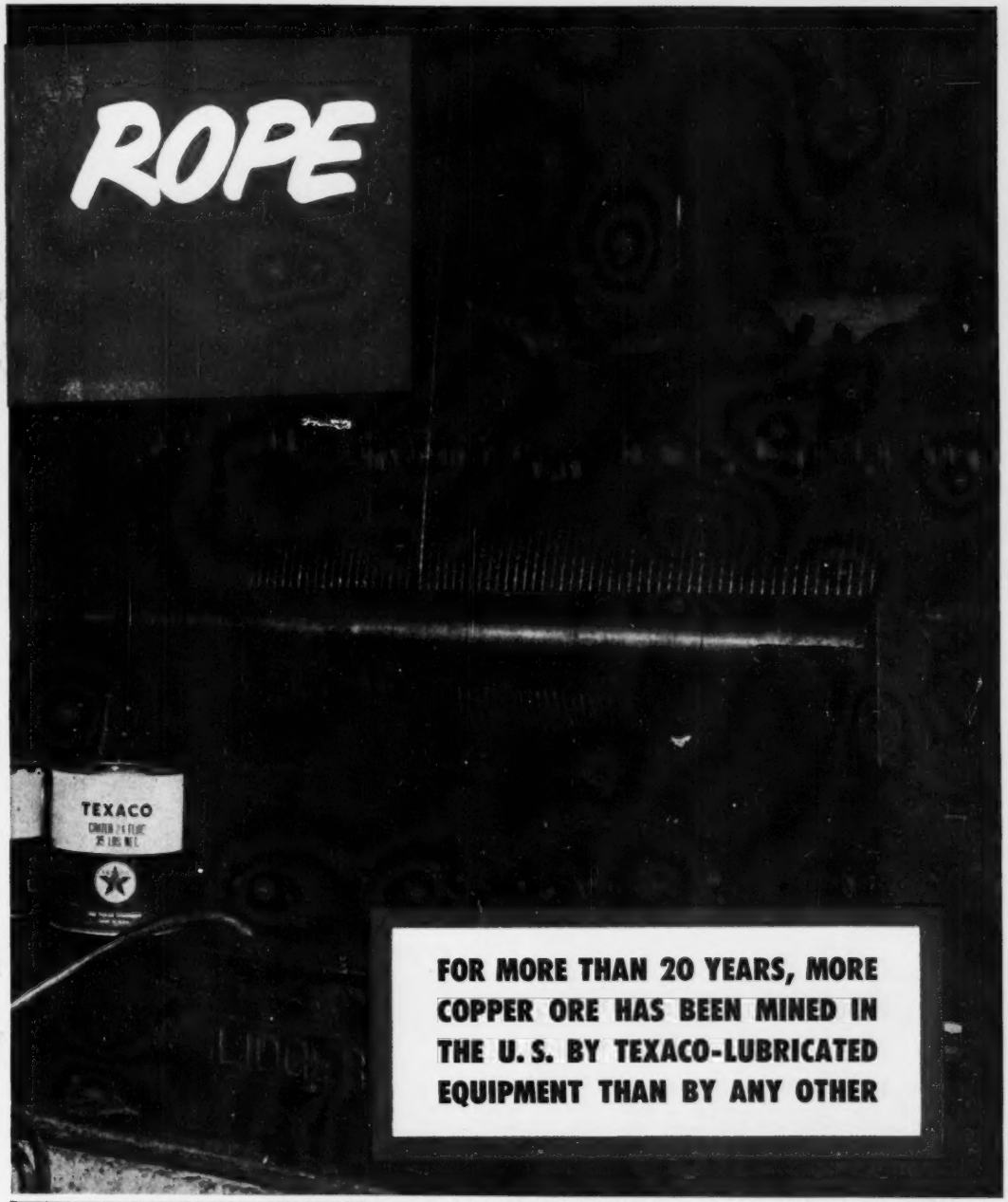
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for Fifty Years

EAGLE-PICHER uses fleet of Allis-Chalmers tractor shovels to

Speed Underground

Eagle-Picher's constant search for new and better ways of mechanizing mining operations has led to the use of 20 Allis-Chalmers tractor shovels to speed underground loading at Tri-State Mines. In addition to this operation, Eagle-Picher has assigned these versatile TRACTO-SHOVELS to a wide variety of other jobs to increase production and reduce costs.

• here's what they do underground...

Loading ore directly into 15-ton hauling units after the ore face has been drilled and blasted.
Excavating — driving drifts through barren ground to reach new ore bodies.
Building and Maintaining all underground haul roads.

• and on the surface...

Loading and Hauling tailings, sand, gravel, silicon, lead and zinc ore, general supplies.
Digging drainage terraces, culverts, pond dams, railroad fills.
Setting and Placing drain tile, pipe, machinery.
Building and Maintaining parking lot and haul roads, cleaning up around hopper.

• new era of tractor usefulness

Today's mining needs require tractors that give high output and yet handle many different types of jobs. TRACTO-SHOVELS measure up to these new standards with performance advantages like these: big-capacity loading . . . excellent maneuverability and compact design for working in confined and low ceiling areas . . . standard electric starting of 2-cycle diesel engines meets necessary safety regulations for underground operation.

Your nearby Allis-Chalmers dealer can give you detailed information on all TRACTO-SHOVEL advantages. See him or phone him soon.

1-YD. HD-5G
2-YD. HD-9G
3-YD. HD-15G
4-YD. HD-20G

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TRACTOR DIVISION • MILWAUKEE 1, U. S. A

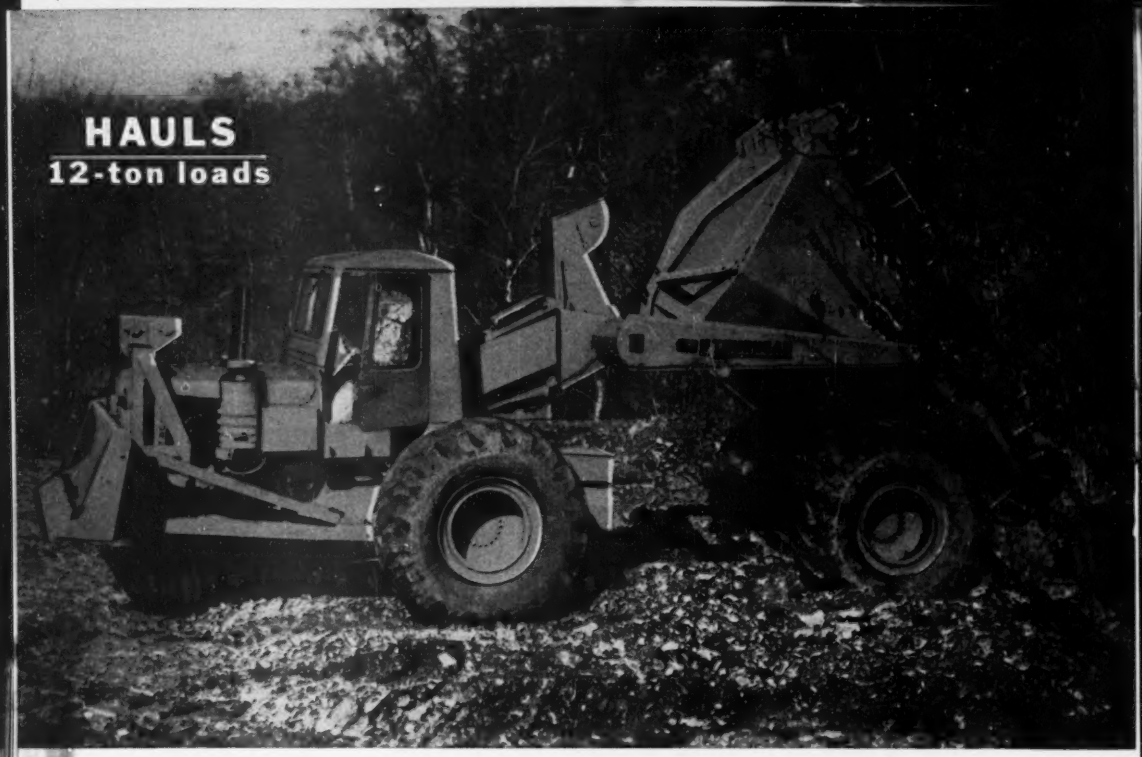
Loading

UNDERGROUND

The 17 HD-20's and 3 HD-9G's load ore into hauling units . . . excavate to reach new ore bodies . . . maintain all underground haul roads.

SURFACE

HD-20's haul and load load and zinc ore, sand and gravel, other bulk material . . . dig drainage terraces, culverts, pond dams, railroad fills . . . build and maintain haul roads and clean up around hopper.



Rear-dump Tournarocker extra unit at W. Virginia

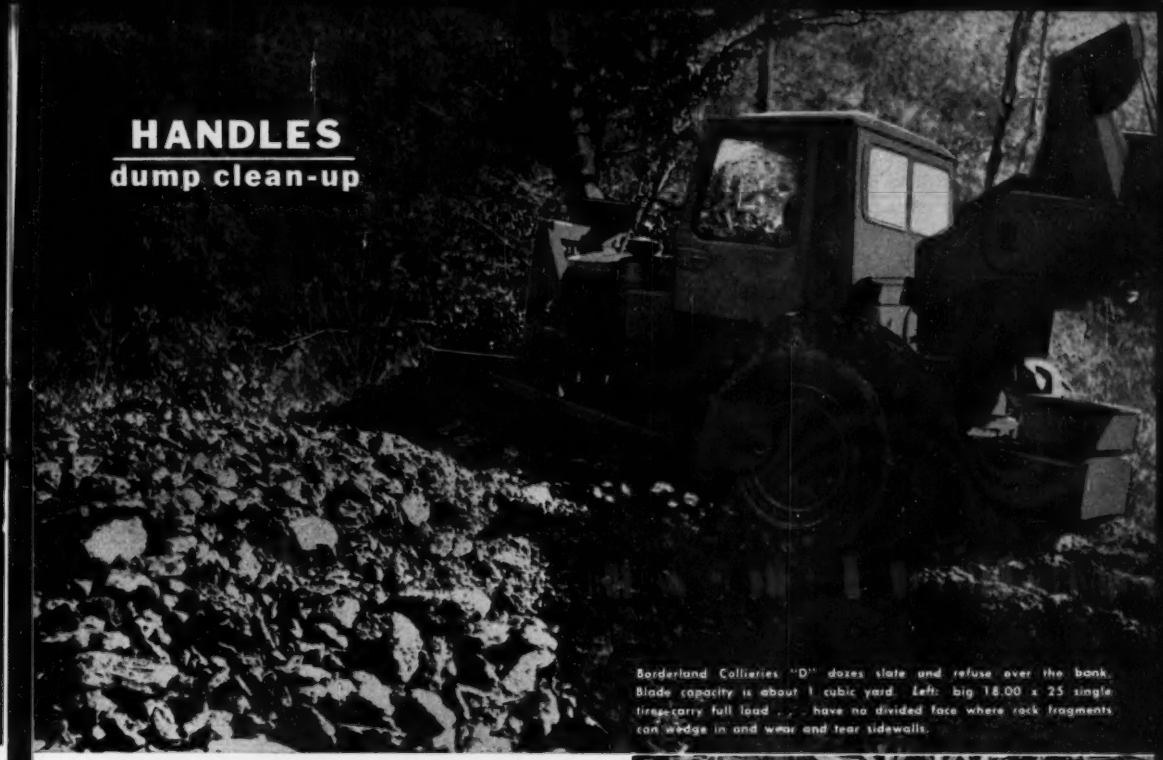
BORDERLAND Collieries of Bluefield cut costs at their Borderland coal mine recently by equipping a versatile D Tournapull prime mover with an electric-control bulldozer blade and a 9-ton rear-dump Tournarocker trailing unit. Rig teams up with standard truck to haul slate and refuse from tipple to spoil bank . . . dumps its load over the bank . . . then, as needed, cleans up spoil. Says Owner Bill Leckie, "The Tournarocker with blade saves us using another unit on the dump. It sure is a time and cost saver."

In spite of oversize 12-ton loads . . . adverse 7 to 10% grades over the winding 1500′ haul road . . . and frequent soft, muddy footing after rains . . . the "D" completes the rugged 3000′ cycle from tipple to dump and return in 2.3 minutes . . . an average speed of 15 m.p.h.

98% efficient in 1100 hours

In 1100 hours, Borderland's Tournarocker has been 98% efficient. By handling 75% of total yardage, it keeps production on schedule, yet cuts inventory, maintenance, and operating costs. To

HANDLES
dump clean-up



Borderland Collieries "D" dozes slate and refuse over the bank. Blade capacity is about 1 cubic yard. *Left:* big 18.00 x 25 single tires carry full load . . . have no divided face where rock fragments can wedge in and wear and tear sidewalls.

eliminates Colliery

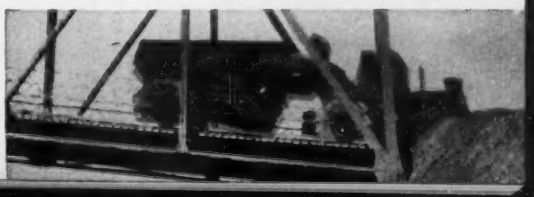
At tipple, Tournarocker with sideboards gets oversize 12-ton load. Reinforced, 3-ply steel-grid bowl takes shock loads of heavy slate without needing constant welding or patching. Simplified construction is rugged and dependable . . . with no frame, springs, hydraulics, you naturally need fewer spare parts, have less maintenance.

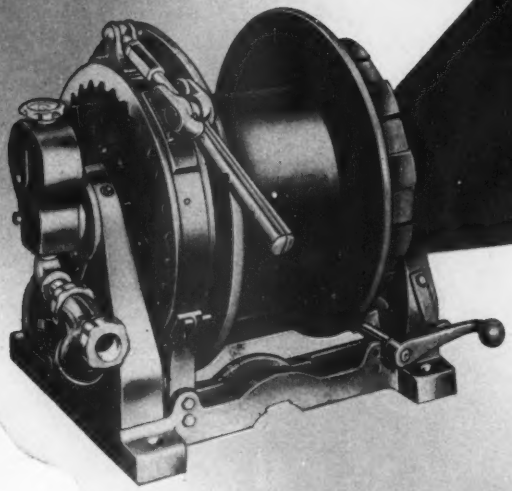
check what Tournarocker can do for you, see your LeTourneau Distributor. Ask him to show you Tournarocker's revolutionary features . . . over-the-bank electric dumping . . . 90° turns within 12′4″ radius . . . positive electric power steer . . . big single tires . . . simplified rugged construction (no frame, sub-frame, springs, hydraulic system) . . . interchangeability of rear-dump with scraper, crane and flatbed. Check owner-verified production reports . . . see for yourself how these features have paid off in extra profits on jobs similar to your own.

On rugged 3000′ cycle, the 122 h.p. "D" averaged 15 m.p.h. Big 4-wheel multiple-disc air brakes (2822 sq. in. total braking surface) have more than 4 times the braking surface of conventional haulers . . . provide safe, higher-speed operation on steep grades and over narrow winding haul roads . . . speeds spotting at shovel and on dump.

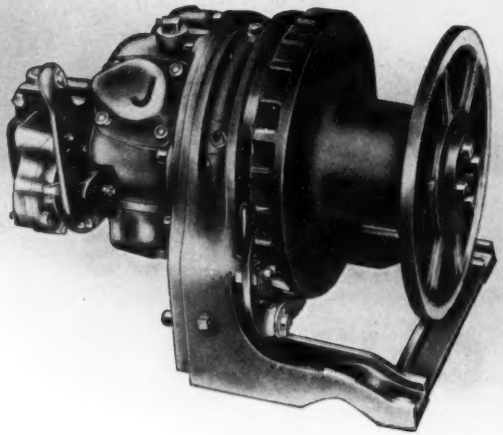
R. G. LeTOURNEAU, Inc., Peoria, Ill.

High-speed, rubber-tired, excavating, hauling, lifting equipment





JOY



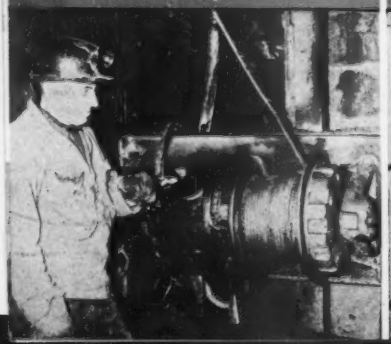
TOP: Model F-113 "Turbinair". Compact, simple design with motor *inside* the drum. Direct power transmission from motor to drum assures maximum efficiency. Simple, accessible controls make operation easy.

RIGHT: Model DW-111 "Pistonair". Features reversible power with light weight. Four-cylinder, 3½ h.p., reversible motor will handle up to 1200 lbs.

FAR RIGHT: Model L-111 "Pistonair". For heavy hoisting jobs. 7½ h.p., reversible, five-cylinder motor for loads up to 2000 lbs.

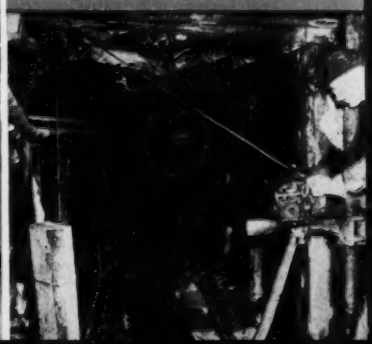
OVER 100 YEARS OF ENGINEERING LEADERSHIP

L-111 reversible "Pistonair" Single Drum Hoist operating in a magnetite iron mine in the Adirondack region of New York.



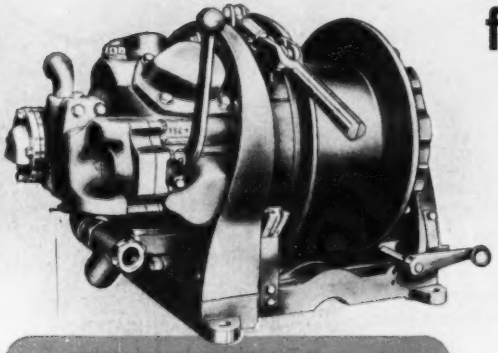
Joy E-112 "Turbinair" lifting timbers in a raise in a western mine. The extra rope capacity of the E-112 (450' of ⅝" rope) makes it applicable to *any* of the utility hoisting needs in this mine.

Joy AW-40 Air Winch hoisting timbers into place in a drift in a Canadian mine. At a weight of only 85 lbs., this unit will lift 500 lbs!



BETTER SERVICE from

SINGLE DRUM HOISTS



They're real Mining Hoists—designed and built from long field experience expressly for underground use

Joy Single Drum Mining Hoists are compactly designed, of modern, high-strength alloy metals, for lighter weight with greater power and efficiency.

The complete Joy line includes the "Turbinair" series which develop maximum horsepower per unit of weight; the "Pistonair" with reversible four or five cylinder motors; and compact, rugged electric-powered models which feature space-saving short-length external motors.

Joy Single Drum Hoists are built with lifting capacities ranging from 500 to 3500 lbs., and rope capacities from 150 to 1500 ft. "Pistonair" models have a positive acting safety brake which holds the load in any position when the throttle valve is "off."

Joy also manufactures a complete line of Shaft Hoists, and Two- and Three-Drum Slusher Hoists in capacities to handle all hoisting and scraping needs.

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Gives You These 3 Big Advantages

Ripl-Flo ROD DECK SCREENS

LESS BLINDING! Sticky materials go through slotted openings between rods with less trouble than through conventional wire cloth or perforated plate. Rods provide a positive cutting action.

GREATER CAPACITY! Undersize passes long openings between rods more readily than through conventional screen surface. There's more open area — and cross wire blockage is eliminated. More tonnage and larger feed can be handled with a rod deck screen.

LONGER LIFE! Rod deck design permits using heavy ¾ to ½ in. rods. The rod deck costs less to operate than a conventional screen — you need only replace worn rods, not an entire screen surface.

MONEY-SAVING APPLICATIONS

- For scalping ahead of crushers.
- Preparing grinding mill feed.
- To replace conventional double deck screen. Rod deck requires less head room, reduces operating cost, handles larger size feed.
- Any screening operation where square separation is not necessary.

Ripl-Flo is an Allis-Chalmers trademark.

ALLIS-CHALMERS A-C

Find out how rod deck screens can cut costs and reduce downtime in your operations. Call the A-C representative in your area, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3752

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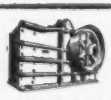
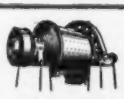
Hammermill

Vibrating Screens


Jaw Crushers

Gyratory Crushers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The development of mechanical improvements for better performance on new equipment doesn't always permit their installation on old rigs. But here at Northwest, *every new improvement* is entered upon with the idea of making the new modern advantages and output of today's Northwest available, if possible, for older machines in the field with a minimum of mechanical difficulty. A policy like this means money in your pocket — added value not only for you but for the man who buys from you. It's another good reason why you should plan to own a Northwest.

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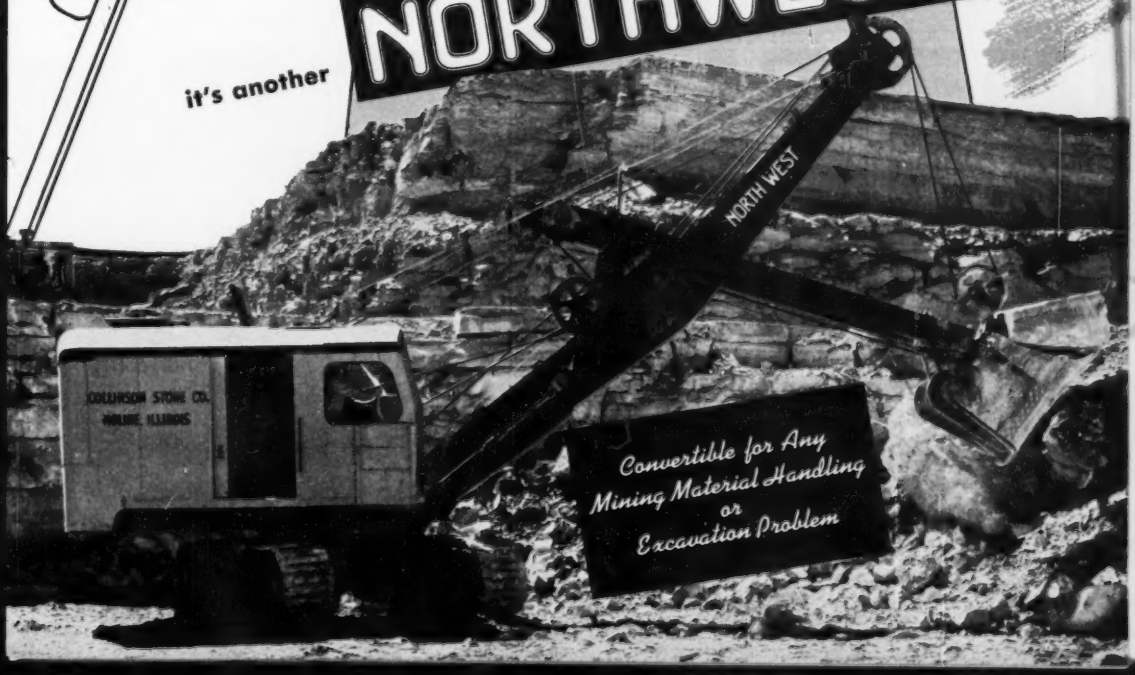
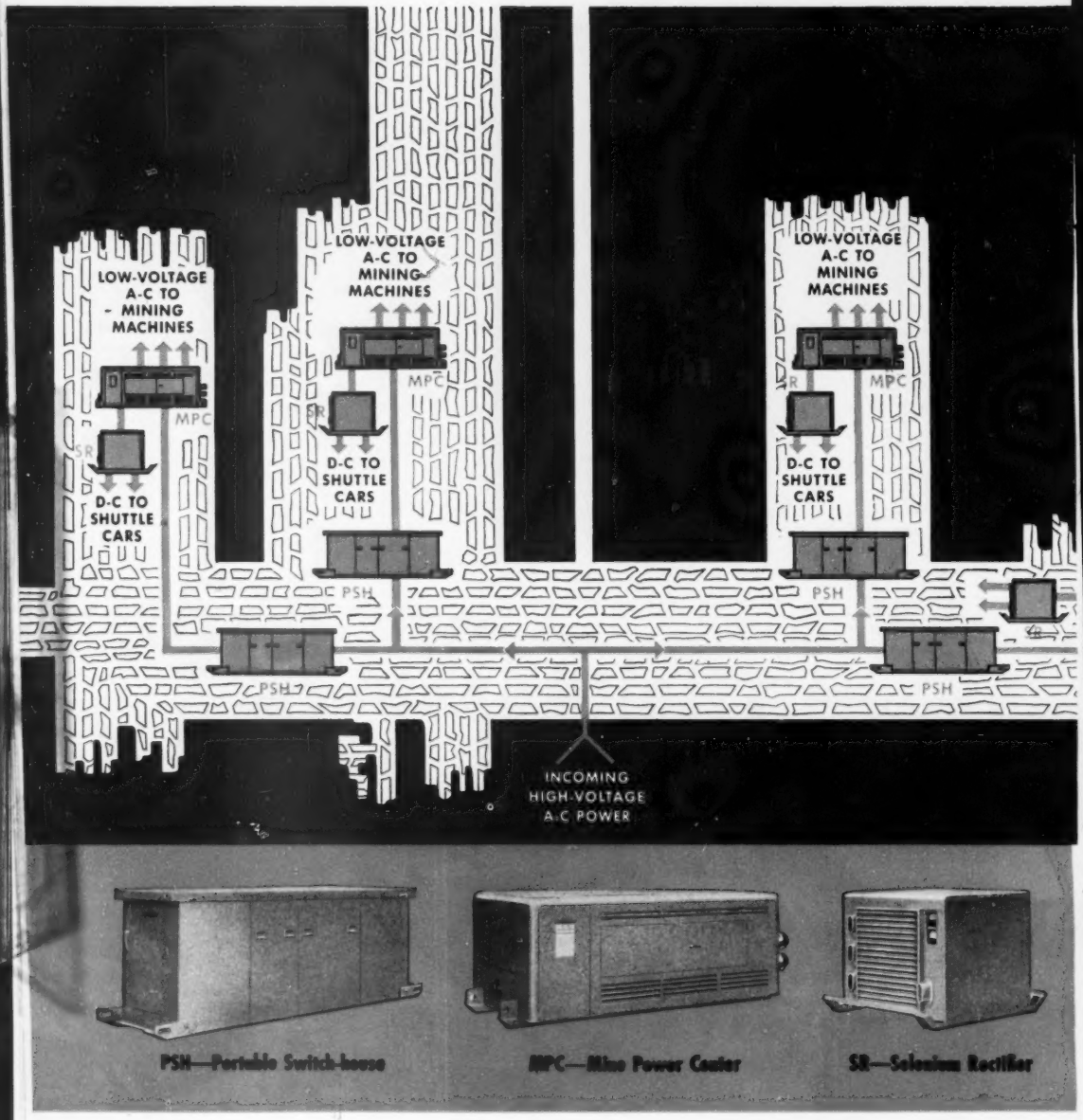
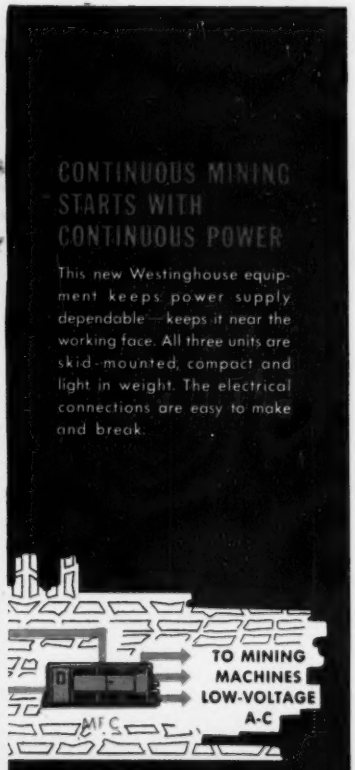
it's another **NORTHWEST** in ROCK




LOW-VOLTAGE A-C TO MINING MACHINES
D-C TO SHUTTLE CARS
MPC
SR
PSH
INCOMING HIGH-VOLTAGE A-C POWER
PSH—Portable Switch-house
MPC—Mine Power Center
SR—Selenium Rectifier

Three new developments for A-C power systems


CONTINUOUS MINING STARTS WITH CONTINUOUS POWER
This new Westinghouse equipment keeps power supply dependable—keeps it near the working face. All three units are skid-mounted, compact and light in weight. The electrical connections are easy to make and break.
TO MINING MACHINES LOW-VOLTAGE A-C
M.F.C.

Here's the latest and best in power supply for a-c mining—three brand-new Westinghouse developments for use underground. Chart at left shows how they're applied.

1. New switch-house controls high-voltage power

High-voltage power comes down a shaft or borehole, then is sent out through individual feeders to the various working areas. Each feeder should be protected. Best way: the new Westinghouse underground switch-house. It immediately isolates the feeder in event of ground-fault, overcurrent or short circuit so that the rest of the system isn't affected.

2. Mine Power Center transforms it down

This new Mine Power Center keeps power supply where it's needed—close to the working face. Four working areas and four Power Centers are shown at left. This new unit is basically an air-cooled transformer with outgoing low-voltage feeders. A circuit breaker protects each feeder against overcurrent and ground-faults.

3. New rectifier supplies small blocks of d-c

Here's the ideal way to supply the small amounts of d-c needed in a-c mines. The new Westinghouse selenium rectifier takes a-c from the Power Center and supplies d-c through circuit breaker protected outlets. There are no major moving parts in this unit—the rectifier itself is a simple, static, plate-type device.

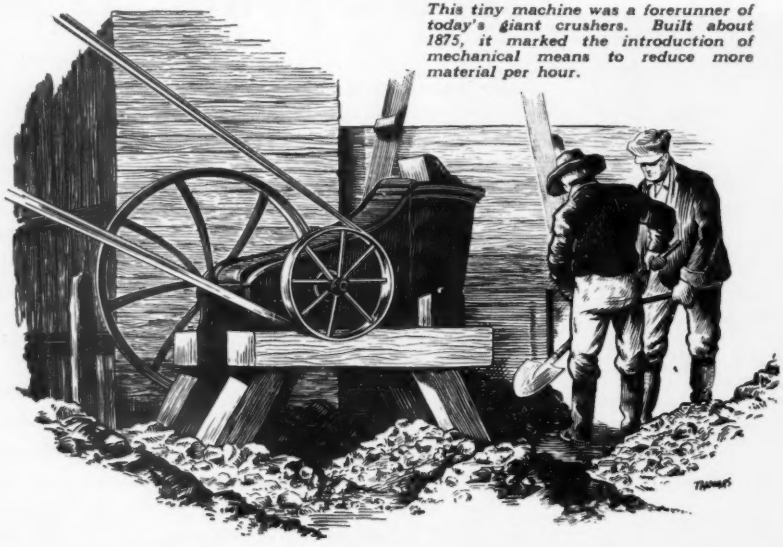
Call Westinghouse early on EVERY job

Westinghouse has a great deal of experience in all types of electrical equipment for mining. We can help you cut costs and improve your operations. When your next project comes up, call your Westinghouse office early in the planning stage. And for more information on these three new developments, write for B-5423. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-94901

YOU CAN BE SURE... IF IT'S
Westinghouse
EQUIPMENT FOR
THE MINING INDUSTRY

A promise of bigger things to come

This tiny machine was a forerunner of today's giant crushers. Built about 1875, it marked the introduction of mechanical means to reduce more material per hour.



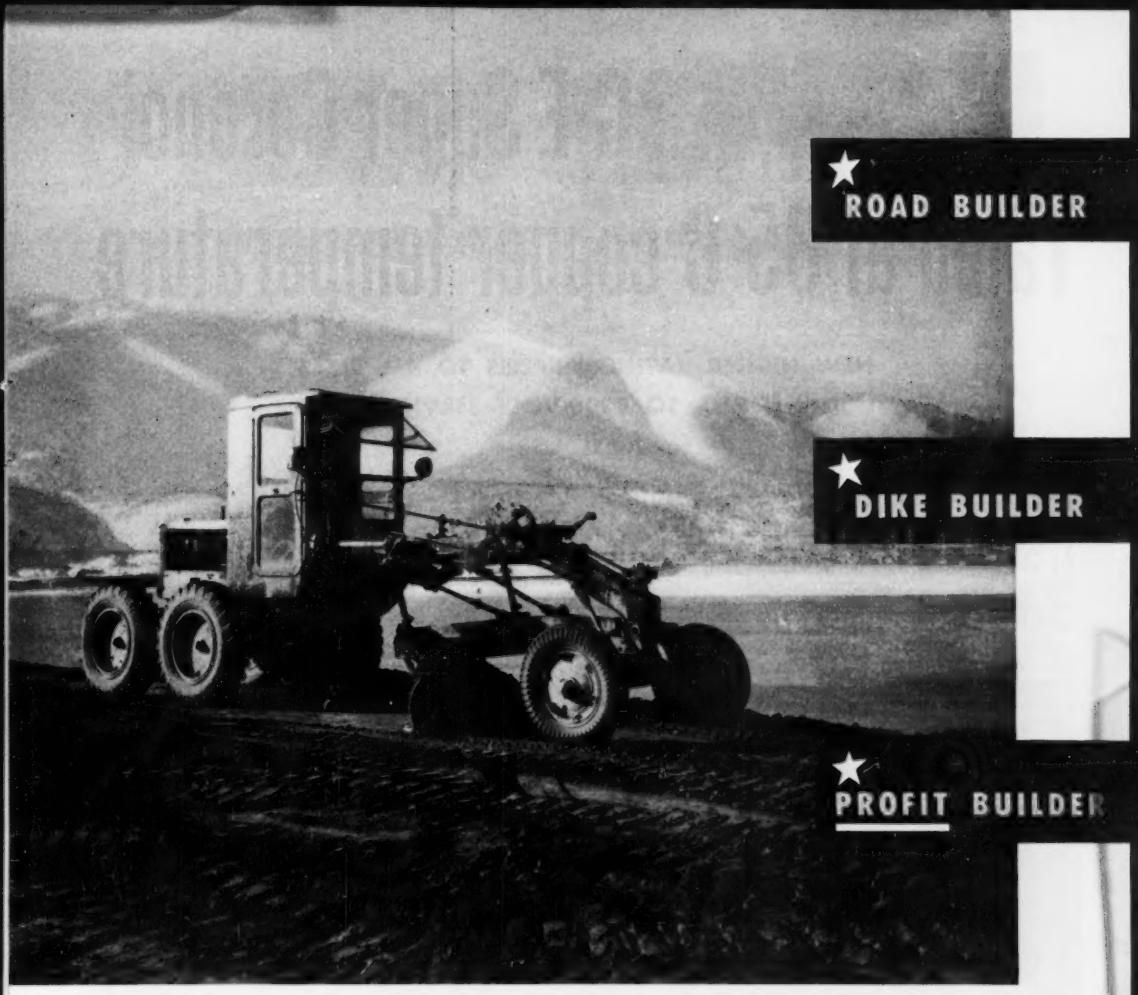
The Traylor TC Gyratory, with its curved concaves and bell head, typifies advanced Traylor design for efficient operation. See Bulletin 126 for complete details.

Step by step, little machines and crude inventions have been developed into powerful, more efficient equipment to keep pace with the needs of a growing nation. For 50 years, Traylor has made it a policy to *lead* in the development and production of better machinery for the mining industry. In that time, mining men have come to depend on the skill and experience of Traylor to supply them with the tools they need. They know that when they consult Traylor, they consult experience . . . half a century of it.

OUR GOLDEN ANNIVERSARY YEAR
1902 1952

TRAYLOR ENGINEERING & MANUFACTURING CO.
1442 MILL ST., ALLENTOWN, PA.
Sales offices: New York · Chicago · San Francisco
Canadian Mfrs.: Canadian Vickers, Ltd., Montreal, P.Q.

a **Traylor** *leads to greater profits*



FIFTY miles of private road serve Bunker & Sullivan Mining Company's lead mill at Kellogg, Idaho. To extend these roads whenever necessary and to keep them all in shape to handle 20-ton trucks, Transportation Supt. H. O. Papineer relies on this "Caterpillar" No. 212 Motor Grader and a D2 Tractor. These big yellow machines also build dikes for the mill's sluice pond. When chores like these are carried out quickly and efficiently, the results show up in any mining company's profit column. That's why Supt. Papineer reports, "We really prefer 'Caterpillar' equipment."

The No. 212 Motor Grader is all-"Caterpillar" built, with engine, controls, transmission, frame and circle assembly *all* built entirely in one factory, all serviced entirely by one organization. Its weight is balanced precisely with its horsepower and working speed. Its mechanical power controls are always dependable and accurate, with new precision-cut curved teeth giving longer life and easier operation. Its tandem drive allows climbing action no other type can give, backs across ditches smoothly, and picks up maximum traction with its four drive wheels directly under the weight of the powerful engine.

More than 99% of all "Caterpillar" Motor Graders built since 1931 are still on the job. Rugged construction and genuine "Caterpillar" parts made that record possible. The same dependable performance can be yours, too. See your "Caterpillar" Dealer.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

NOW... G-E Super Coronol* rated at 85 C copper temperature

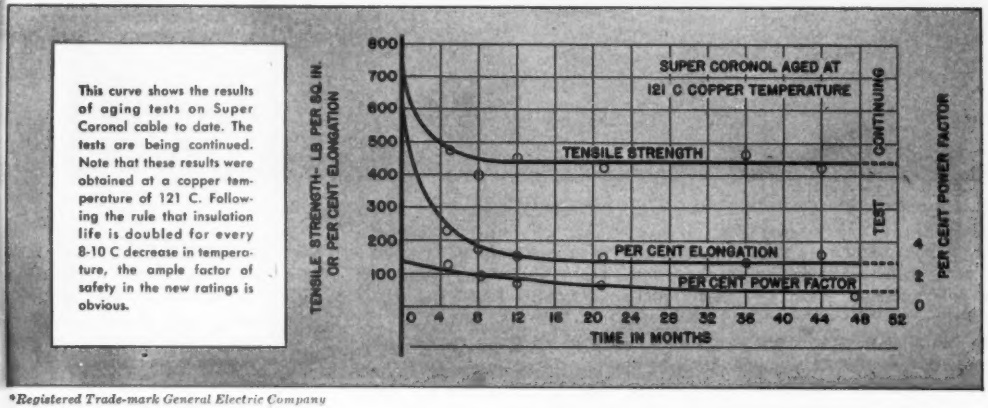
NEW HIGHER RATING APPLIES TO ALL SIZES FOR 0- TO 8000-VOLT SERVICE

General Electric announces that effective immediately it is basing the ratings of all Super Coronol power cables for service up to and including 8000 volts on a permissible maximum copper temperature of 85 C. To our knowledge this is the highest rating ever announced for a solid dielectric power cable in this voltage range. For voltages above 8000, ratings continue to be based on 80 C.

The new temperature ratings mean that Super Coronol cables are now capable of carrying up to 12 per cent more power, continuously, than old-style ozone-resisting rubber-type compounds rated 75 C maximum.

This higher rating is a conservative increase, based on life tests of many cables taken from regular production. Most severe, and at the same time, most impressive of these tests involves cable held continuously under load at a copper temperature of 121 C. This test is now nearing the end of its 5th year. Both physical and electrical properties have been stable since the 20th month. In view of such results, the new rating is still extremely conservative—*and can safely be applied to all Super Coronol cable now in service at potentials up to 8000 volts.*

G-E cable specialists in your area will be glad to help you calculate just what this new rating means in current-carrying capacity in any specific installation—both for continuous loading and for emergency overloads. Or you may wish to write Section W45-1095, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.


This curve shows the results of aging tests on Super Coronol cable to date. The tests are being continued. Note that these results were obtained at a copper temperature of 121 C. Following the rule that insulation life is doubled for every 8-10 C decrease in temperature, the ample factor of safety in the new ratings is obvious.
TENSILE STRENGTH- LB PER SQ IN. OR PER CENT ELONGATION
800
700
600
500
400
300
200
100
SUPER CORONOL AGED AT 121 C COPPER TEMPERATURE
TENSILE STRENGTH
PER CENT ELONGATION
PER CENT POWER FACTOR
CONTINUING TEST
4
2
0
PER CENT POWER FACTOR
0 4 8 12 16 20 24 28 32 36 40 44 48 52
TIME IN MONTHS

*Registered Trade-mark General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

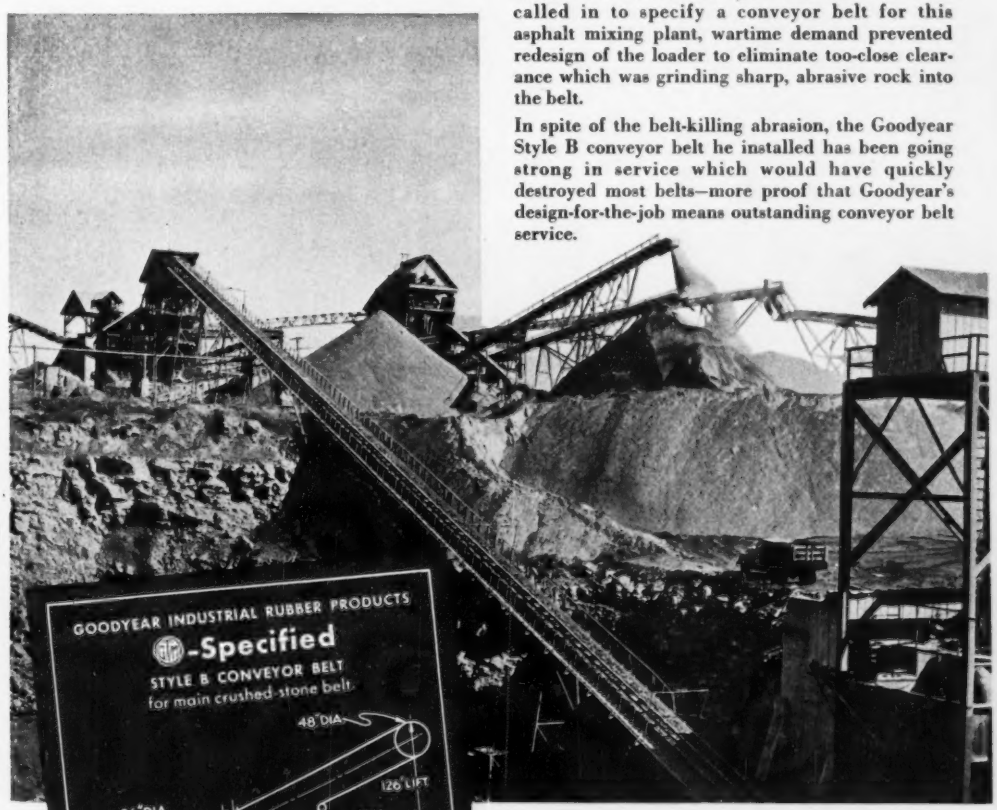
Single conductor-Geoprene jacket | Single conductor shielded Geoprene | Pre-assembled aerial cable | Mine Power Cable | Two-conductor concentric lighting cable

6 YEARS' SERVICE-

3,500,000-plus tons *and still going strong!*

When the G.T.M.—Goodyear Technical Man—was called in to specify a conveyor belt for this asphalt mixing plant, wartime demand prevented redesign of the loader to eliminate too-close clearance which was grinding sharp, abrasive rock into the belt.

In spite of the belt-killing abrasion, the Goodyear Style B conveyor belt he installed has been going strong in service which would have quickly destroyed most belts—more proof that Goodyear's design-for-the-job means outstanding conveyor belt service.

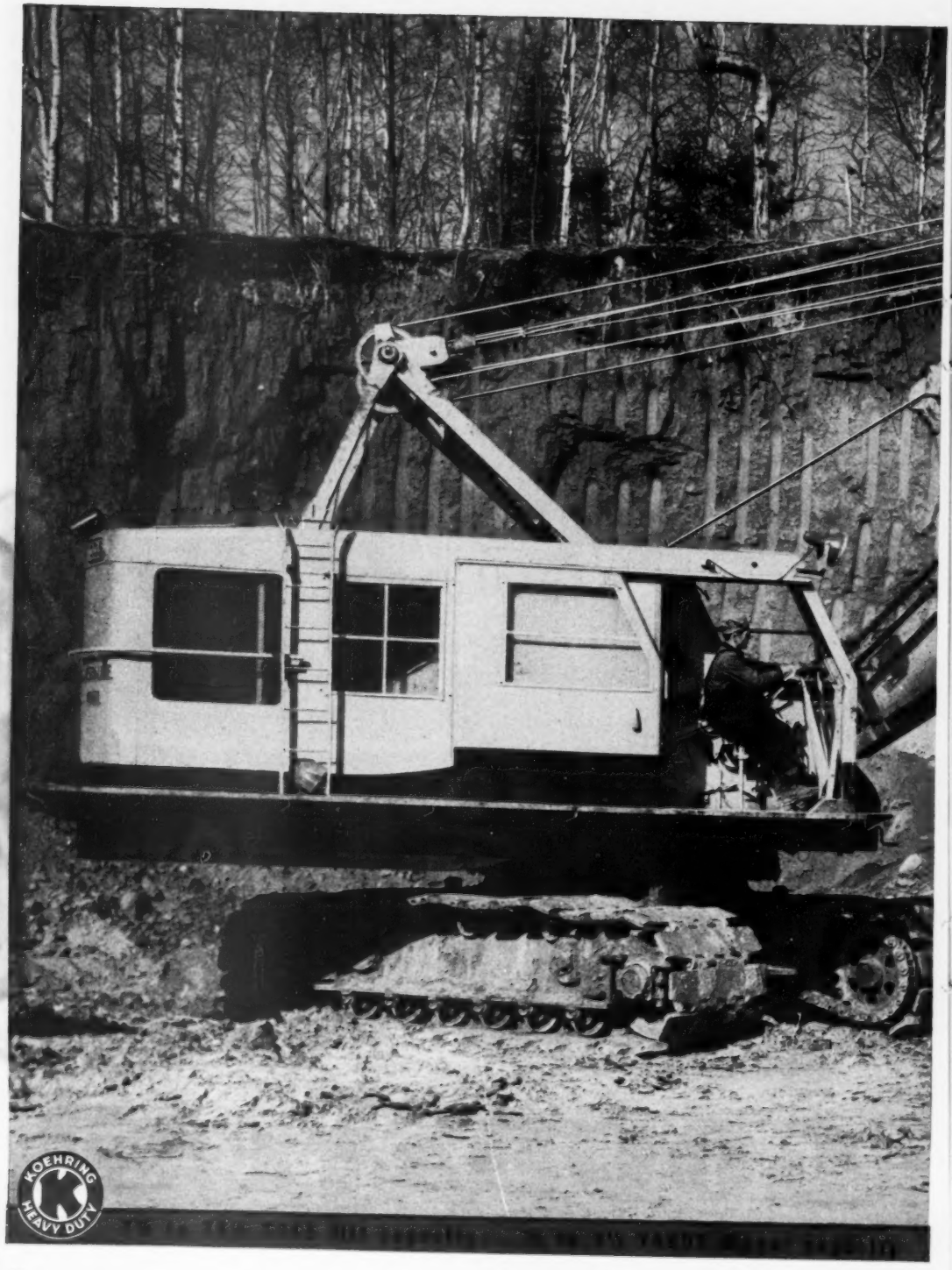


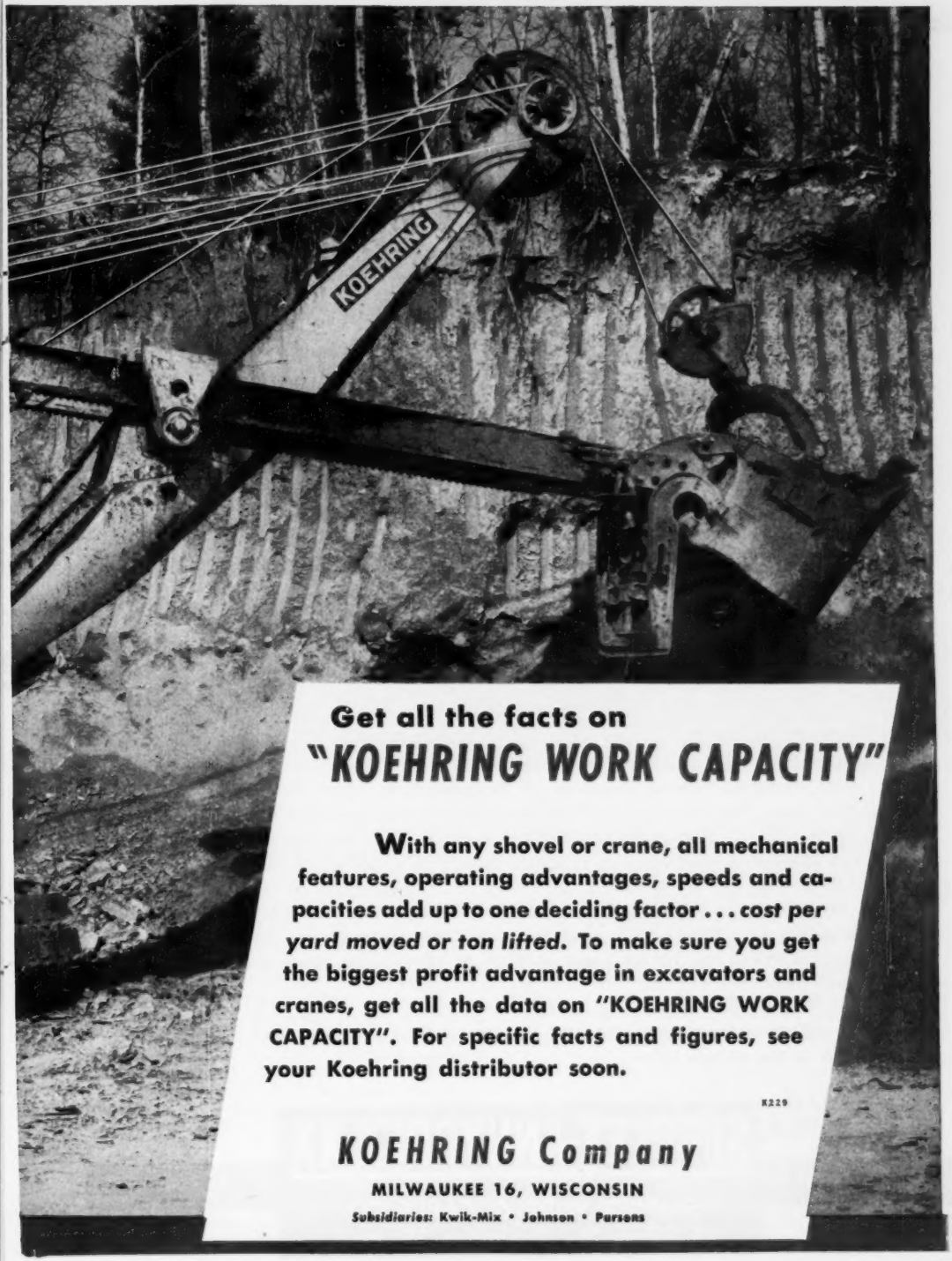
LOOK FOR YOUR GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR *in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods." He handles Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, Rubber-Covered Rolls built to the world's highest standard of quality.*

We think you'll like "THE GREATEST STORY EVER TOLD" Every Sunday — ABC Network

GOODYEAR

THE GREATEST NAME IN RUBBER


KOEHRING
HEAVY DUTY



Get all the facts on

"KOEHRING WORK CAPACITY"

With any shovel or crane, all mechanical features, operating advantages, speeds and capacities add up to one deciding factor . . . *cost per yard moved or ton lifted.* To make sure you get the biggest profit advantage in excavators and cranes, get all the data on "KOEHRING WORK CAPACITY". For specific facts and figures, see your Koehring distributor soon.

K229

KOEHRING Company

MILWAUKEE 16, WISCONSIN

Subsidiaries: Kwik-Mix • Johnson • Parsons

As with every other product, there can be weakling cables and robust cables. Weakling cables are those that can be classified as having anemia of the insulation. In other words, they do not have the insulation stamina to stand up under the electrical and physical conditions to which they will be subjected. It's this kind of cable that will haunt you.

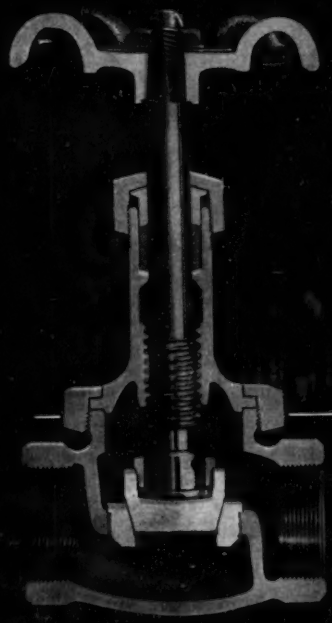
Simplex-ANHYDREX XX Cables come from a robust family. They have a guaranteed water absorption of only 15 milligrams of water when tested in accordance with U.S.C.G. specifications. They will not crack when exposed to severe ozone conditions. Simplex Anhydrex XX insulation is so robust that it will withstand these tests before or AFTER the insulation has been aged for 7 days at 250°F. (121°C.). Simplex-ANHYDREX XX Cables are recommended for operation at copper temperatures up to 176°F. (80°C.) in either wet or dry locations.

Here is an insulation that doesn't ask for special favors. It's the kind of insulation you should have on your important feeder, network, and station cables that operate in the voltage range of 2,000 to 17,000 volts. These cables won't haunt you.

Want to know more about this robust insulation? Simply send your request to the address below.

SIMPLEX-ANHYDREX XX

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.



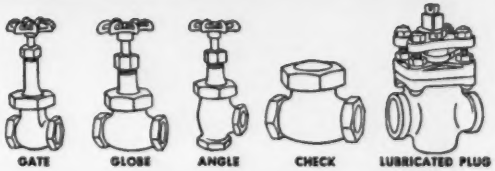
BRONZE

COMPLETE LINES OF BRONZE VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns, including Walseal® Bronze Valves and Fittings for making Silbraz® joints.

Walworth also manufactures complete lines of valves and fittings — including Lubricated Plug Valves — made of steel, iron, and special alloys as well as bronze.

Walworth-made valves, pipe fittings, and pipe wrenches, total approximately 50,000 items—all sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For full information call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.



Bronze valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 225P Bronze Globe Valve. This valve has a working steam pressure rating of 350 psi at 550F (1,000 psi non-shock cold water, oil, and gas pressure). It features a renewable, plug type, stainless steel seat and disc, heat treated to 500 Brinell hardness.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

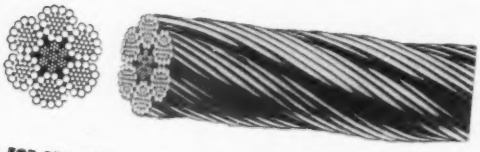
60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

The Proper Rope *Plus*

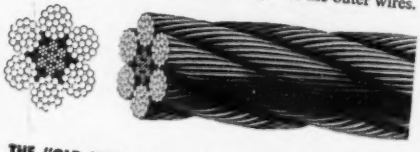
TO COMBAT FATIGUE Tiger Brand 6x37—Type S Excellay Preformed. This rope is listed as "Special Flexible Hoisting Rope" and is also known as "Crane Rope." It is the most flexible of standard constructions which permits its use with small sheaves and drums. Its reserve strength is highest of the standard constructions.

TO COMBAT ABRASION American Tiger Brand 6x19 Seale Patent Excellay Monitor Preformed Wire Rope offers greater resistance than regular hoisting ropes because of the large, uniform wire diameters of the outside wires in each strand. Lang Lay construction also increases the resistance by a better distribution of the wear over a greater length of the outer wires.



FOR RESISTING CRUSHING, the introduction of a steel core instead of regular fiber core in the various types of ropes, minimizes the harmful effect of crushing and maintains the intended position of all strands in the rope.

The section of American Tiger Brand 6x30 Type G Excellay Flattened Strand Lang Lay with I.W.R.C. as shown, combines the features of increased strength because of the large metallic area, greater distribution of wear on the outside wires, resistance to crushing of the core and flexibility because of the type of rope itself.



THE "OLD WORKHORSE" Tiger Brand 6x19 Type N Excellay Preformed Standard Hoisting Rope is more widely used in a greater variety of applications than any other type. It has a superior combination of qualities—good resistance to abrasion and fatigue, high strength and long life. With wire core it has 7½ percent greater strength than with fiber core.

More than a million tons of oyster shells have been converted into chemicals at this plant. The owners have found that Tiger Brand Wire Rope stands up best under these severe abrasive conditions, cutting rope costs, reducing down time and keeping equipment at top capacity.

The slings do the thing, especially when you are handling heavy lifts such as the machinery shown here. And Tiger Wire Rope Slings are designed to handle all jobs promptly, safely and economically. They are made of the toughest, strongest wire rope manufactured, and come in many types. Write for our book, "American Tiger Wire Rope Slings."

Proper Maintenance

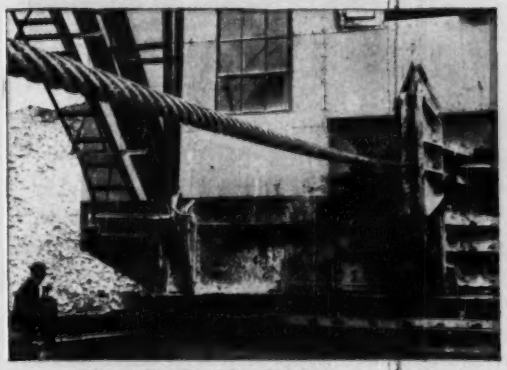
Equals Longer Rope Life Lower Rope Costs

● Many prominent users of wire rope have found they can reduce wire rope costs as much as 50% by using a wire rope designed for the job. They get better rope service at lower rope cost by following this simple, job-tested system, with the help of the Tiger Brand Wire Rope Specialist.

Let this qualified expert make *sure* that you select, for each job, a wire rope that is strong enough to carry the load with an ample margin of safety . . . able to stand incessant flexing and sharp bending without failure of wires due to fatigue . . . built to take the most severe abrasion and crushing. Then make sure that every foot of wire rope you own is inspected, cleaned and lubricated *regularly*.

Engineers and contractors who follow this procedure tell us that they are getting twice—sometimes three times — the life they expected from Tiger Brand Wire Rope, plus greater safety for crews and equipment and freedom from rope-caused work stoppages, all of which means important money savings.

When you are in the market for wire rope, make full use of the engineering knowledge of an expert who has made a life-work of analyzing and solving wire rope problems. Just drop us a line and your Tiger Brand Wire Rope Specialist will be glad to consult with you. Meanwhile, why not send in the convenient coupon for a copy of our latest book?



This new Tiger Brand Drag Line Rope was designed especially to resist the extremely severe operating conditions encountered in this class of service. On one job where ropes lasted an average of 600 hours, this Tiger Brand Drag Line Rope was still going strong after 1100 hours—believe it or not!

Send for This NEW BOOK

It contains specification data that will help you select the right rope for each application. In descriptive text, illustrations, diagrams and tables, it gives you complete information on types of rope, diameters, working loads and safety factors for all sorts of rope service.

American Steel & Wire
Rockefeller Building, Dept. C-10
Cleveland 13, Ohio

Please send me your new book, "Specification Data, Tiger Brand Wire Rope."

Name_____

Company_____

Address_____

City_____ Zone__ State_____

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

"Drop her just an inch, Mike"

—faster, smoother way to set a beam

An outstanding advantage of Allison TORQMATIC DRIVE is that it gives the operator *positive control of the load at all times*—an important time and moneysaving feature in setting steel girders and beams.

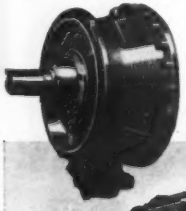
With TORQMATIC DRIVE, the operator can "inch" loads into place without clutching, declutching or friction braking. *He controls the load with the throttle!*

This combination torque converter and fluid coupling gives all kinds of heavy-duty construction equipment greater smoothness and operating ease. It starts big loads easier and moves them faster. It cushions shock loads—reduces wear and tear on engines and equipment. It cuts operator fatigue—*gets more work done in less time at lower cost.*

Now successfully working in trucks, tractors, hoisting machinery and all kinds of earth-moving equipment, Allison TORQMATIC DRIVE is ideal with heavy-duty engines delivering 75 to 350 horsepower. For full details, write:

ALLISON *Division of* GENERAL MOTORS
Box 894M, Indianapolis 6, Indiana

GM GENERAL MOTORS



Allison TORQMATIC DRIVES

SCRAPERS TRACTORS TRUCKS SHOVELS LOCOMOTIVES DRILLING RIGS

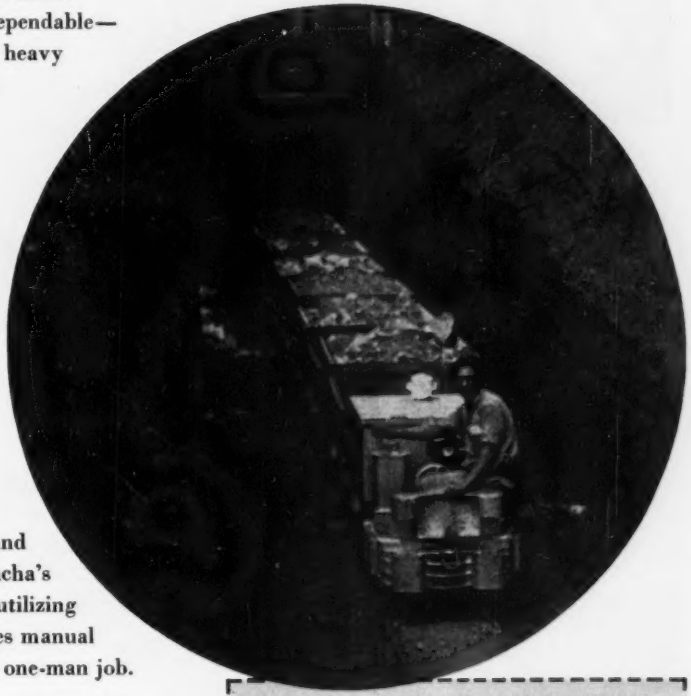
When mining men talk profit...

they talk about

MANCHA

STORAGE BATTERY LOCOMOTIVES

From experience they know Mancha locomotives are thoroughly dependable—engineered to stand up under heavy hauling assignments year-in, year-out with minimum maintenance.



They've learned from experience the advantages of Mancha chassis design: *Strength without excess weight.* It means extra battery power is available to move payloads.

They approve Mancha's patented Trackmaster design that levels out rough track—prevents derailment and lost time. And they like Mancha's time-saving battery change, utilizing a transfer rack that eliminates manual labor, and makes changing a one-man job.

In short, mining men like Mancha Storage Battery Locomotives for reasons that mean *extra profit.*

Find out what a Mancha can do for you. Write for our mine haulage Data-Form—*today.*

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Ill., U.S.A.
EAMJ-1052
Send your mine haulage Data-Form

NAME.....

FIRM.....

ADDRESS.....

CITY.....ZONE.....STATE.....

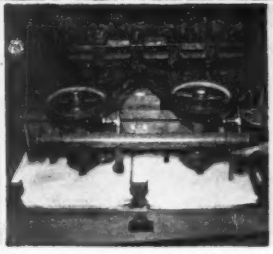
MANCHA STORAGE BATTERY LOCOMOTIVE
Division GOODMAN Manufacturing Company
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

TAILINGS yesterday

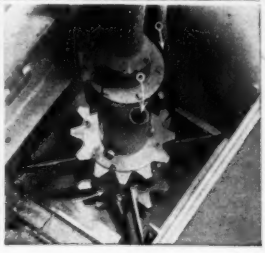
. because of the price of metal.

New Denver "Sub-A" Super Rougher Flotation Machine in roughing circuits aids in getting values which are now profitable with higher prices!

The Denver "Sub-A" Super Rougher Flotation Machine features a low pulp level, adjustable froth depth and double overflow so froth may be quickly discharged before bubbles drop their load. Photo shows a 2-cell, No. 18 Sp. (32x32) Denver "Sub-A" Super Rougher Flotation Machine, filled with water. Depth of water is 18". Intense agitation and aeration raises froth to 26", a deep froth of 8"



Controlled feed to the agitation chambers add to the flexibility of the unit. Feed to agitating chamber is regulated by rubber bushing to meet ideal flotation conditions. An adjustable sand relief opening is placed low in the cell. Pulp level is adjusted by a handwheel weir gate at the end of every two cells. This is a double impeller mechanism.



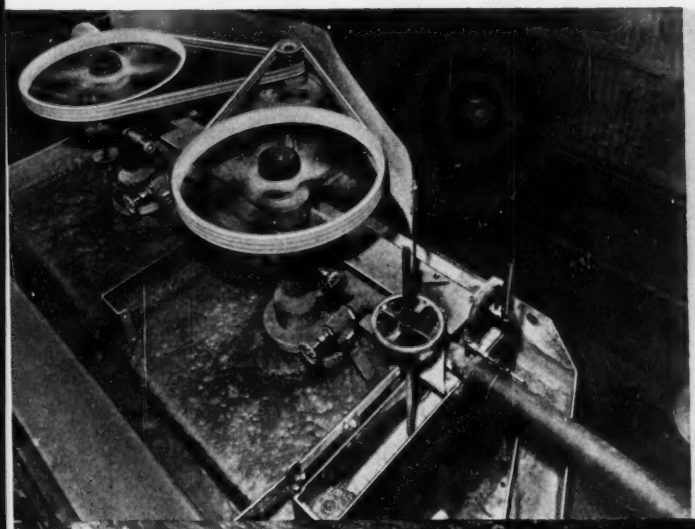
DENVER EQUIPMENT

1402 17th Street, Denver 17, Colorado

Our 25th year of Flotation

may be PROFITS *today!*

Here's the *New* Denver "Sub-A" Super Rougher Flotation Machine to recover more values . . .



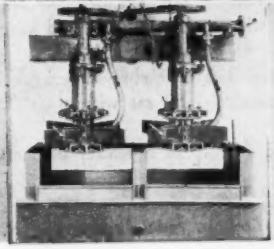
Here is a flexible Flotation Machine that gives intense aeration and short-distance froth overflow, so important on extremely low-grade ores and coarse-grind feed. As a scavenger machine at the tail end of a circuit, the unit increases your mill efficiency by lowering tailings losses.

Featuring a low pulp level, this NEW Denver "Sub-A" Super Rougher Flotation Machine offers controlled aeration, intense agitation, and regulated feed. These are the flexible tools your flotation engineer needs to get results that pay greater profits.

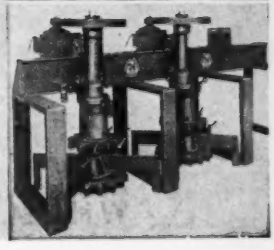
The world's leader in flotation engineering, Denver Equipment Company adds the Denver "Sub-A" Super Rougher Flotation Machine to its long list of continuous flotation machine improvements. You can buy all of your ore dressing equipment from DECO, you get everything from testing to dryer from one company, one responsibility, without a premium.

Find out how you can get more PROFIT out of your ore with a Denver "Sub-A" Super Rougher Flotation Machine. Phone, write or wire today!

For simplified repair, the entire assembly may be removed easily. All wearing parts are standard and interchangeable with other Denver "Sub-A" machines. Single or double impeller mechanisms provide maximum aeration and are furnished to meet your specific recovery and frothing objectives.

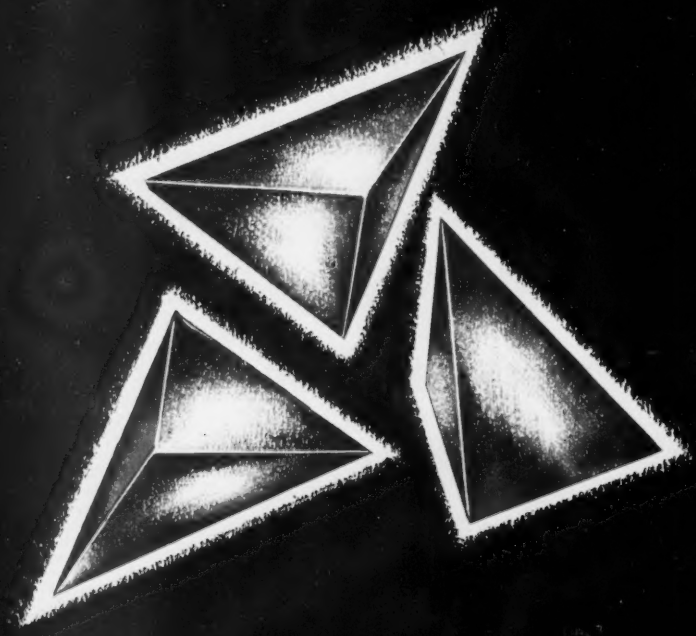


Conversion units are built for most makes of flotation tanks. You get the same mechanisms that are standard on the new Denver "Sub-A" Scavenger Machine. This gives you the advantages of standard, reliable DECO service and efficiency. More Denver "Sub-A" Flotation Machines are used for roughing and cleaning than all other makes combined. Find out how you can profit by converting to Denver "Sub-A."



COMPANY

Engineering



ATOMIC SCIENTIST No. 1 DID US ALL A GOOD TURN

Nature, the original atomic scientist, created in the diamond one of her great masterpieces.

In finer industrial qualities the atoms are arranged in tetrahedral form and billions of them are compacted in even the tiniest diamond crystal. They form the hardest substance known to man, long prized as the supreme cutting medium.

Other diamond structures are often agglomerate; a sort of mineral pudding of diamond atoms in various crystalline arrangements, excellent in many applications but without the peculiar atomic structure which gives the selected diamond its incomparable cutting power.

The diamonds used in Truco diamond drill bits have always been selected with due observance of their individual characteristics—and set with their "best side toward the work."

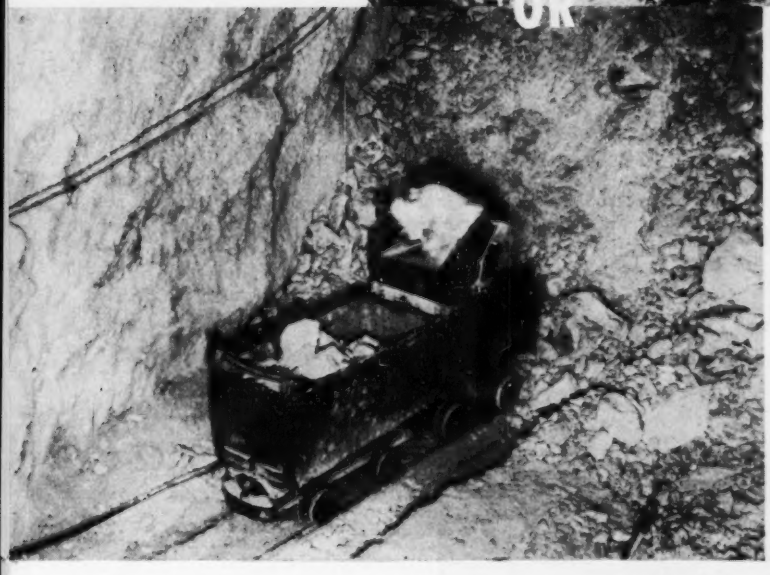
Their superior performance in the field follows as a matter of simple logic.

WHEEL TRUEING TOOL COMPANY
3200 W. DAVISON AVENUE, DETROIT 6, MICHIGAN

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 LANGLOIS AVENUE, WINDSOR, ONTARIO, CANADA

IF YOUR MINE IS WET

OR



IF YOUR MINE IS DRY

You can't beat an Eimco

EIMCO R401

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES - SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES:

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
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EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIF., 637 CEDAR STREET
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE: SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND: EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
IN ITALY: EIMCO ITALIA, S.P.A., MILAN, ITALY.

YOU'LL LOAD OUT BEST WITH AN EIMCO

All Eimco loaders are made of ALLOY STEEL castings. The heavy-duty decks can be sealed against water or dust getting in and oil coming out. You don't even have to check the oil, in full 3 shift operation, any oftener than once a month.

In addition to this they are the fastest in loading, most dependable in operation and cheapest to operate both in maintenance and air consumption.

Check the costs of operating mechanical loaders at other mines before you decide — there's an Eimco for your size of drift and car.

You get more ore every shift with the

SMOOTH, FAST WORK CYCLE

of Bucyrus-Erie's 38-B

SPEED is a traditional characteristic of Bucyrus-Erie excavators . . . and speed in the individual dig, swing and dump operations only tells part of the story.

In the Bucyrus-Erie 38-B, working speed starts on the drawing board, where cycle functions are balanced with one another (as well as being designed fast in themselves) . . . and coordinated with proper weight distribution. Adding smooth, steady power . . . liberally used anti-friction bearings . . . easy-filling dippers . . . and direct-action mechancial control gives it the overall production speed that has made Bucyrus-Erie the standard of the industry.

Most Compared . . .

BUCYRUS ERIE

Most Preferred

Eliminating lost time and waste motion is one big way to boost output *wherever* excavators are used. Now . . . when that counts more than ever, you can count on Bucyrus-Erie excavators to "deliver the goods." 88E52

BUCYRUS-ERIE, South Milwaukee, Wisconsin

True simplicity of design, with large, strong parts make the Bucyrus-Erie 1½-yd. 38-B an outstanding mining machine . . . both for efficiency and dependability.

7 out of every 10

are repeat orders

ALLIS-CHALMERS

GRINDING MILLS

OPERATING MEN who have had actual experience with Allis-Chalmers grinding mills will usually specify A-C mills again... as proved by our sales records.

Repeat orders, of course, come only from customers who have been well satisfied. That's why we're proud of the fact that 7 out of 10 new Allis-Chalmers grinding mills go to operators for whom we have supplied mills in the past.

Ask the Allis-Chalmers representative in your area about the many high output and low maintenance advantages of Allis-Chalmers grinding mills. Or write for Grinding Mill Bulletin 07B6718A. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3845

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Hammermills

Vibrating Screens

Jaw Crushers

Gyratory Crushers

Grinding Mills

Kilns, Coolers, Dryers

Cut drilling costs with THROWAWAY Bits...

Save Steel
Save Powder

1 Easily deformable skirt permits quick removal of bit from shank. No lost time with stuck bits.

2 Ample chip clearance allows faster drilling.

3 Short reaming sides eliminate sticking and allow close gauge following.

4 Blunt non-breaking cutting edges have self-sharpening tendency . . . are uniformly tempered hard, biting steel.

5 Large hemispherical non-plugging water outlet.

6 Lathe-cut, ground or forged parallel shank fits firmly into close tolerance bit socket. No threads required. Perpendicular socket wall allows shank to bottom in bit for maximum performance.

7 Perfect uniformly treated bit teeth assure best possible cutting power and smooth operation.

LOWER your drilling costs with smaller holes and faster drilling. Bottom with 1¼ inch holes and save costly steel and powder. Let us prove to you that the man at the drill can do more work for less cost with a Throwaway Bit. Write for new low price list and technical description of Throwaway Bit to: Portland, Oregon home office or distributors listed below. Competent field engineers and dealers are always at your service.

THROWAWAY BIT CORPORATION

4200 N. W. YEON AVENUE., PORTLAND, OREGON

BONNE TERRE FARMING & CATTLE CO
Bonne Terre, Missouri

CREATING ENGINEERING
825 1st National Bank Building
Denver, Colorado

GREENAWALT-WHEELOCK & CO.
415 Mills Building
El Paso, Texas

Every small worm gear unit is built to precision standards—as outstanding in quality and performance as larger size Clevelands. Illustrated above are the 10 AT (left) and 00 D (right) speed reducers.

Enjoy the benefits of worm gear drives in smaller CLEVELAND speed reducers

WHEN you want a quiet, powerful, dependable drive for a small machine, choose a Cleveland Worm Gear Speed Reducer.

As built by Cleveland, the worm gear reducer is a drive of many advantages:

1. It is compact and inherently quiet, transmitting power with smooth, uninterrupted torque flow.
2. Its right-angled design saves valuable space.
3. It has a minimum of moving parts.
4. Shock load resistance and other factors of safety are high.
5. Rate of wear of case hardened steel worm on nickel-bronze gear is very low, insuring long life.

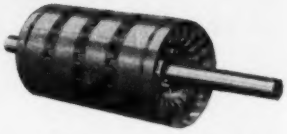
Write for Bulletin 114F which illustrates and gives engineering data on smaller size Clevelands—many now available for immediate delivery. The Cleveland Worm and Gear Company, 3281 E. 80th St., Cleveland 4, O.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers

Which Answers Your Tramp Iron Problem BEST?

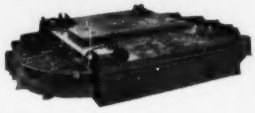
MAGNETIC PULLEYS?



Powerful, air cooled electro magnetic pulleys are ideal where well loaded conveyor belts are used. Installed as head drive pulley, tramp iron is discharged automatically. Low operating cost, long life and extreme power characterize this workhouse of the Dings line. Catalog C-1001A tells you why this magnet is exceptionally efficient.

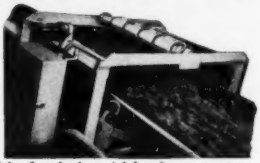
Dings *non-electric, self-energized* Perma Pulley magnets are recommended where burden depths do not exceed 3". Within this range, these are the magnets to use because of their unsurpassed concentration of magnetic strength near the surface. Catalog C-1007A.

SUSPENDED RECTANGULARS?



Power close and power that searches down as deep as 30" to yank tramp iron out. If the Dings RM rectangular won't do it, it can't be done. Triple pole, double gap design. Install horizontally, vertically or at an angle above belt conveyors or in chutes. Self-cleaning fully automatic models also available. Write for details.

MAGNETIC DETECTOR?



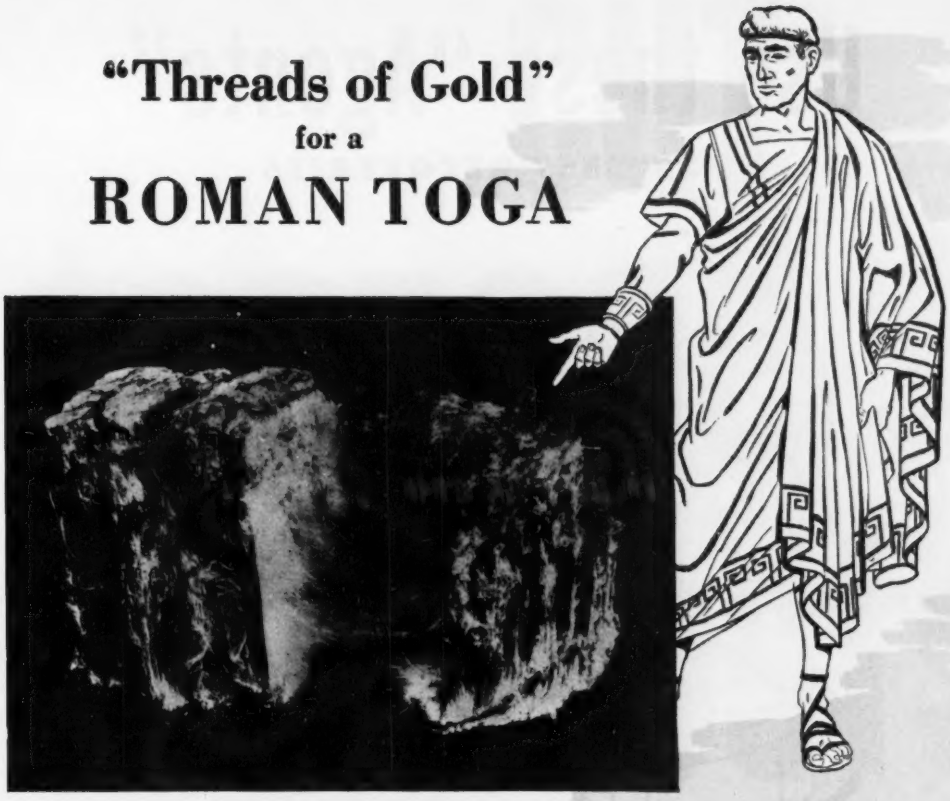
The Dings Magnetic Detector instantly signals when any magnetic object large enough to be damaging passes through the detector zone. Can be hooked up to sound an alarm and stop the belt. Ideal protection for crushers, grinders, pulverizers, etc., where belt speeds are so excessive or burden depths so great no magnetic separator can fuction successfully. Detectors are available for belt widths from 18" to 72". Two types are available. One employs an electro magnet and the other, a permanent magnet. Performance of the two is comparable.

Magnets shown here are available in size ranges for most applications. Special magnets can be made for any application. Write today for recommendations.

DINGS MAGNETIC SEPARATOR CO.
4716 W. Electric Ave., Milwaukee 46, Wis.

Dings Certified MAGNETIC PULLEYS

"Threads of Gold"
for a
ROMAN TOGA

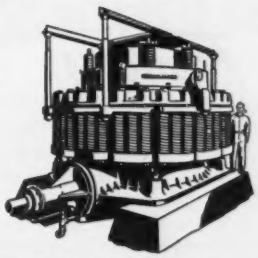


The mineral *Chrysotile,* meaning golden fibers, or threads, supplies over 90% of the world's asbestos requirements. Called the "miracle mineral" by the ancients, the Roman naturalist Pliny (23—79 A.D.) refers to the use of such material as "a rare and costly cloth" used for the funeral garments of kings.

The secret of the great usefulness of asbestos lies in its unique combination of fibrous structure, fire and water resistance, flexibility and strength. Since the profitable recovery of asbestos fiber depends upon fine crushing without destroying fiber length, a crusher that will perform such functions economically, and will produce large quantities of finely crushed material, is essential.

Proof of the world-wide acceptance of *"SYMONS"* Cone Crushers in asbestos production is found in the field, where practically every major producer employs these high capacity, economical machines . . . *as in all of the great ore and industrial mineral operations the world over.*

NORDBERG MFG. CO., Milwaukee, Wisconsin



"SYMONS" Cone Crushers . . . *the machines that revolutionized crushing practice* . . . are built in Standard, Short Head, and Intermediate types, with crushing heads from 22 inches to 7 feet in diameter—in capacities from 6 to 900 tons per hour. C252

"SYMONS" . . . A NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON • TORONTO
MEXICO, D.F. • LONDON • PARIS • JOHANNESBURG

Use these "Agents"

FOR BEST RECOVERIES

Frothers

HERCULES YARMOR® F PINE OIL
Standard of quality among pine oil frothers since the early days of flotation. Yarmor F Pine Oil produces a strong froth of good volume, satisfactory texture, and excellent cell-life stability.

Collectors

RADA (Hercules Rosin Amine D Acetate)
Siliceous mineral collector that has good solubility and handles easily.

Rosin Amine Derivatives: Special purpose collectors; uses vary with type of materials to be floated.

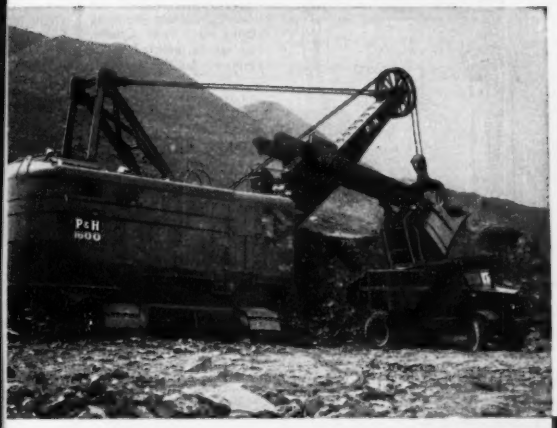
Technical information on these and other flotation aids is available. Send for 16-page booklet "Flotation and Hercules Flotation Agents."

HERCULES Flotation Agents

HERCULES POWDER COMPANY Naval Stores Department, 933 King Street, Wilmington 99, Delaware

NM52-1

cut tonnage costs



with P&H ELECTRIC SHOVELS

In more and more locations these ultra-modern P&H machines are taking over the jobs that call for big production — steady digging. Users who know their cost accounting come back for more — for one proved reason . . . *lower tonnage costs.*

Contributing factors are these:

P&H Magnetorque* Hoist Drive powers hoisting motions electro-magnetically, gives you snappier dipper action — eliminates hoist generator, slip friction clutch and other troublesome mechanical devices.

P&H stepless power regulation is smooth and accurate — with no control fingers or contactors to give you trouble.

Independent propel, all-welded construction, filtered air cab and other modern refinements have led the way to more dependable production on a year-in, year-out basis.

If you seek lower tonnage costs in open pit work, let us tell you where you can see a P&H Electric Shovel in action. Ask about a P&H today.

*T.M. of Harnischfeger Corporation for electro-magnetic type clutch

Every third P&H Electric Shovel sold is a repeat order

HARNISCHFEGER
CORPORATION
4400 West National Ave. • Milwaukee 46, Wisconsin

POWER SHOVELS • CRAWLER AND TRUCK CRANES • OVERHEAD CRANES • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • DIESEL ENGINES • PRE-FABRICATED HOMES

YEARS-AHEAD ENGINEERING...

NEW GYRATORY CRUSHER WITH DOUBLE DISCHARGE OUTLETS

World's Largest Manufacturers of Crushing, Mining and Cement Machinery

For over a half-century, KVS has pioneered and developed many of the most important methods and machines used for crushing, mining and the manufacture of Cement and Lime.

Typical of this "Years-Ahead" engineering is the new KVS gyratory Crusher with double discharge outlets. It's another Kennedy "first" in design and provides the answer to the sticky ore problem that has baffled crusher manufacturers for years.

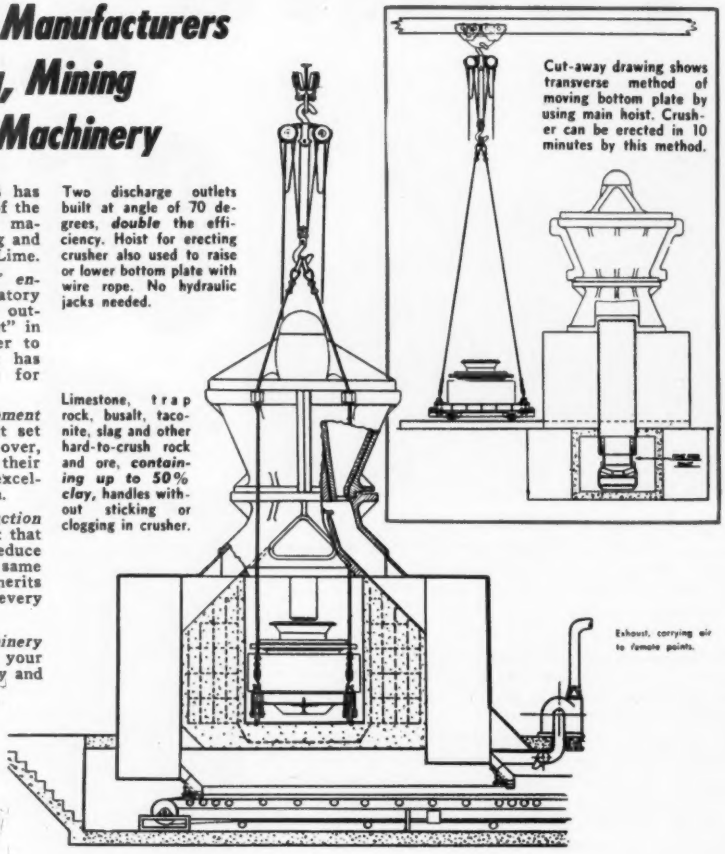
All KVS machinery and equipment presents exclusive features that set them apart. In use the world over, these products are noted for their individual designs, mechanical excellence and economical operation.

In these days of high production costs, machinery and equipment that will increase *daily* output, reduce maintenance costs, and at the same time, increase *yearly* profits, merits the serious consideration of every operating company.

There's a piece of KVS machinery and equipment that will help your plant to operate more efficiently and profitably.

Two discharge outlets built at angle of 70 degrees, ***double*** the efficiency. Hoist for erecting crusher also used to raise or lower bottom plate with wire rope. No hydraulic jacks needed.

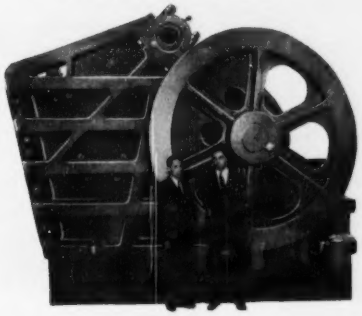
Limestone, trap rock, busalt, taconite, slag and other hard-to-crush rock and ore, ***containing up to 50% clay,*** handles without sticking or clogging in crusher.

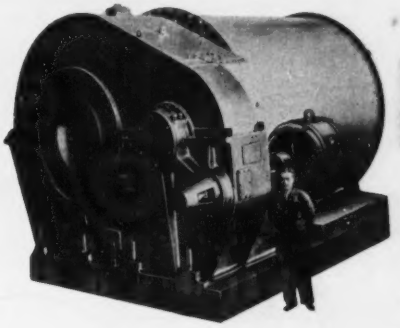

Cut-away drawing shows transverse method of moving bottom plate by using main hoist. Crusher can be erected in 10 minutes by this method.
Exhaust, carrying air to remote points.

SEND FOR LITERATURE DESCRIBING ALL KVS MACHINERY AND EQUIPMENT!

ASSURES CONTINUED LEADERSHIP

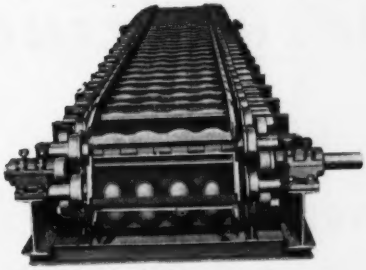
SWING JAW CRUSHER

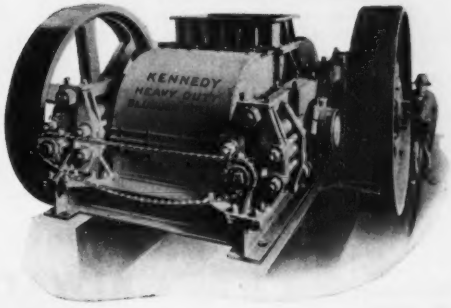




INTEGRAL GEAR DRIVEN MILL

HEAVY-DUTY ROCK FEEDER

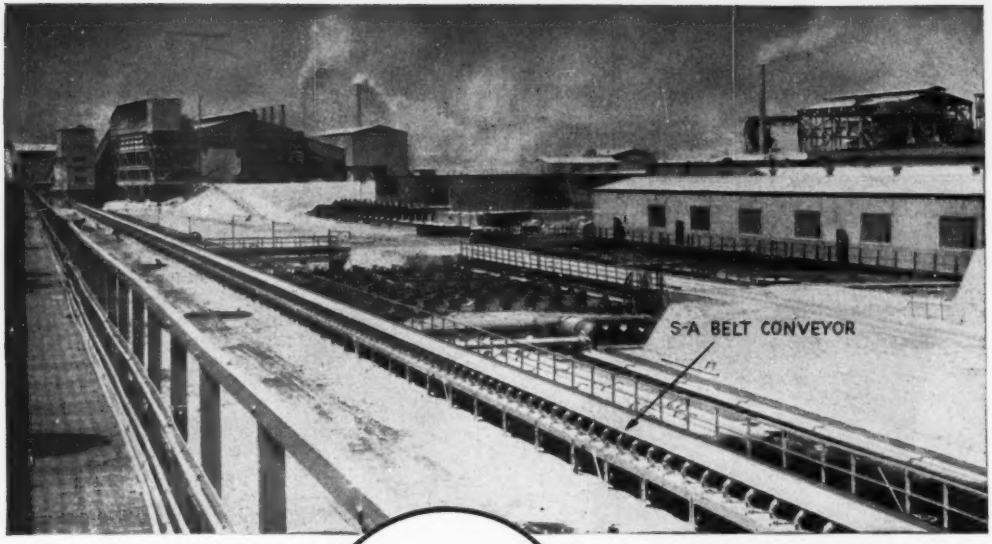




HEAVY-DUTY
SLUGGER ROLL

ROTARY KILN

IT COSTS LESS.. TO OWN THE BEST!



New carriers, "exactly the same as originally furnished," were ordered by the owners when planning an extension to their conveyor system. The 60" wide conveyor, which has moved over 90 million tons of crushed and screened ore, is equipped with S-A Style No. 444 live shaft, heavy duty carriers.

S-A CONVEYING Systems

for Heavy Duty **ORE HANDLING**— **ALWAYS** at Lowest Cost per Ton

S-A bulk materials handling equipment has cut costs and provided efficient handling in scores of ore mining and processing installations. That's why, over and over again, owners have re-ordered S-A equipment for extensions and enlargements of their ore handling facilities.

During its more than 50 years in the bulk materials handling field, Stephens-Adamson has developed a complete line of equipment and an experienced engineering staff. This combination of men and equipment enables S-A to design and build conveying systems that will move your materials at the lowest cost per ton. Write for details today.

- Belt Conveyors
- Belt Trippers
- Belt, Pan & Plate Feeders
- "AMSCO" Steel Pan Feeders
- Ship Loading Boom Conveyors
- Stacking Conveyors
- Storage & Reclaiming Systems
- Flight & Chain Conveyors
- Screw Conveyors
- "Natural Frequency" Vibrating Conveyors
- REDLER Conveyor-Elevators
- ZIPPER Conveyor-Elevators
- Conveyor Belt Cleaners
- Headshaft Holdbacks
- Grizzlies & Screens
- Centrifugal Pilers
- Bin Gates & Tunnel Gates
- Car Pullers & Spotters
- Hoists & Winches
- Bucket Elevators
- Skip Hoists
- SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above.

STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

What's ahead for you?

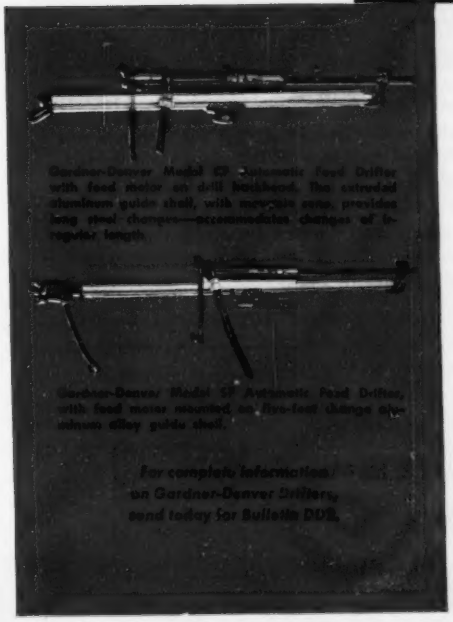
Increased demands for ore production from your mine?

A stepped-up development program to reach your ore reserves?

Hard rock you've got to "hole through" in a hurry?

A program to hold down production costs?

Gardner-Denver CF89H Automatic Feed Drifters.



For help in solving mining problems such as these, choose famous Gardner-Denver Automatic Feed Drifters. They're designed by men who know what it takes to do a fast, low-cost drilling job underground.

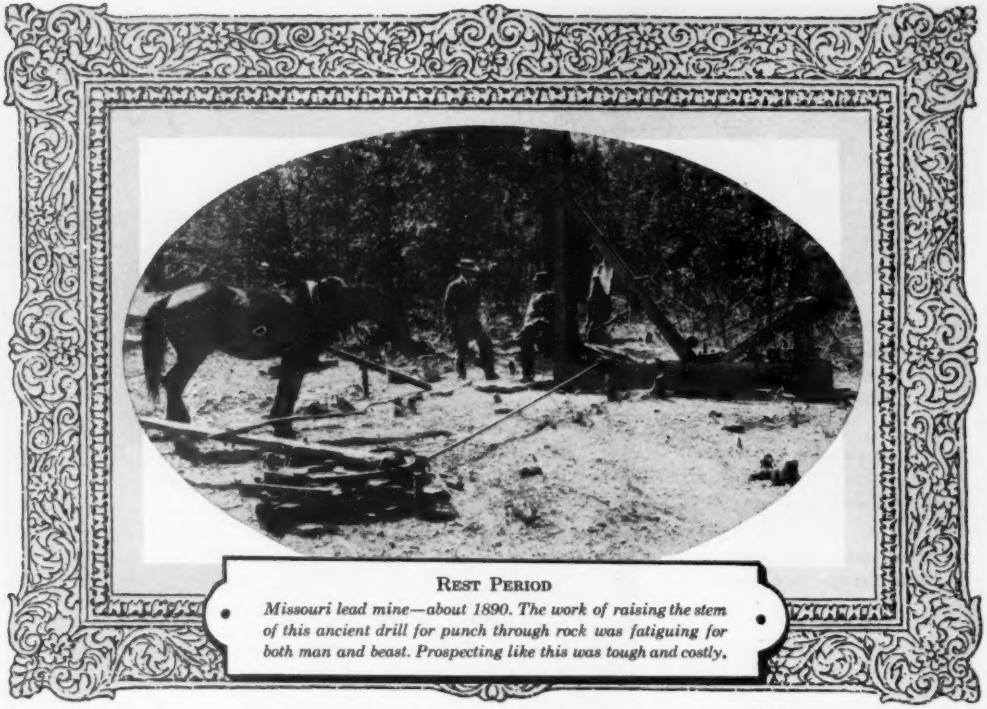
The Gardner-Denver self-adjusting feed, for example, responds automatically to bit penetration — is automatically regulated by the type of ground being drilled. Maximum drilling speed is easily maintained—"green" miners drill almost as fast as "old-timers." The long-wearing, "slow-motion" piston feed motor is economical to operate, too—uses only 3% to 5% of the total air consumption of the drill.

SINCE 1859

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS



REST PERIOD

Missouri lead mine—about 1890. The work of raising the stem of this ancient drill for punch through rock was fatiguing for both man and beast. Prospecting like this was tough and costly.

An enlargement of this photo suitable for framing is yours for the asking.

Times Have Changed...

But some blasting techniques used today are as obsolete as this horse-operated prospecting drill!

Miners have replaced horses with machines . . . have learned to make the most of *mechanical* power to bring out more ore at less cost. But they cannot forget that blasting practices must also be kept up to date to show a profit.

That's why alert mine operators are re-examining standard blasting practices. And they are finding that milli-second delay detonation—pioneered by Atlas in the ROCKMASTER Blasting System—is now leading the field in making the most of explosives energy.

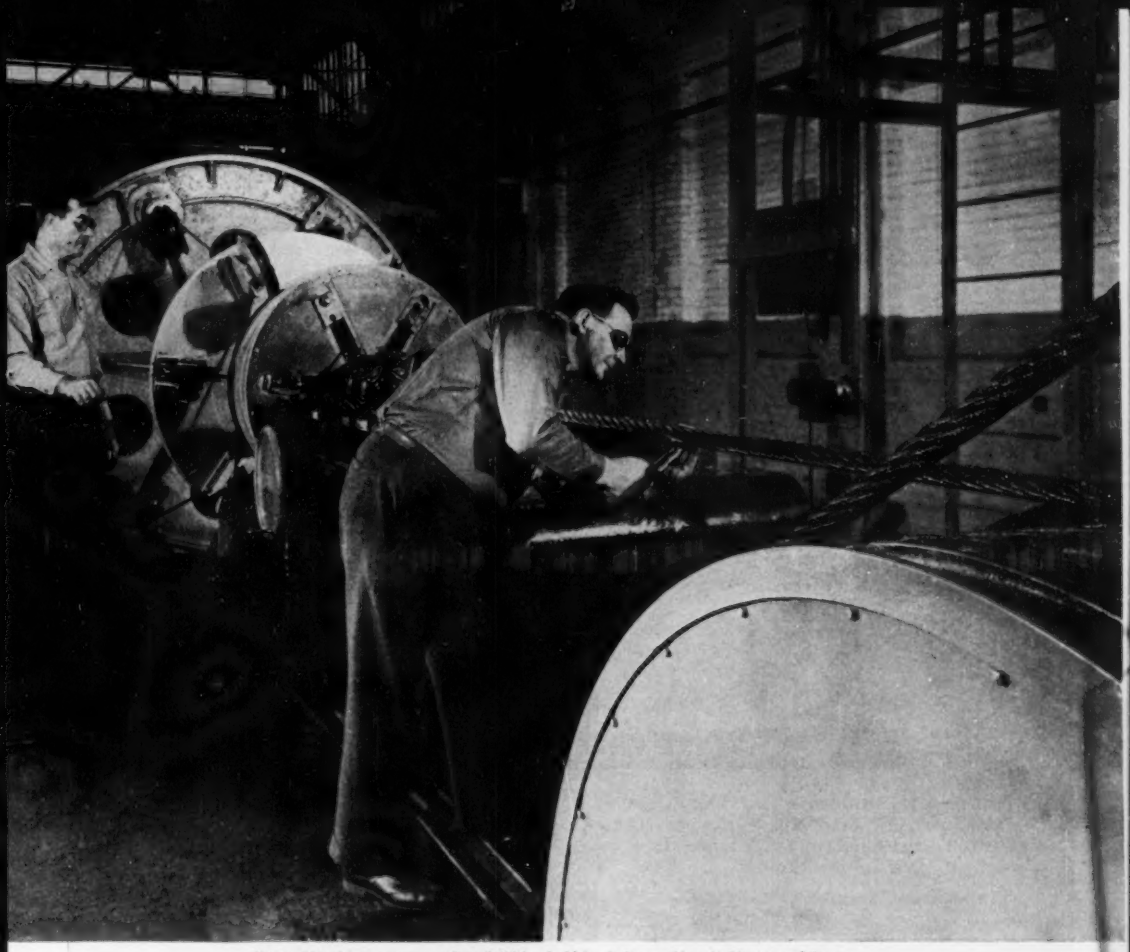
The ROCKMASTER system constantly is being developed to give even more effective drill patterns and loadings for underground work . . . properly tailored to a particular job. ROCKMASTER blasting gives miners results never before possible . . . plus control over breakage, throw, noise, and vibration.

Bring *your* blasting practices up to date *now*. Send for the free 20-page booklet on ROCKMASTER blasting.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*



Here a big wire rope emerges from Bethlehem's 66-in. closing machine. At this stage of the checking, the inspector is making sure that the diameter is within specified tolerances.

He seldom has to say "No"

Saying "no" can be part of the Bethlehem rope inspector's job. Fortunately, he seldom has to use the veto power, for Bethlehem rope is made with such care that rejects are few. But the inspector won't hesitate to stop a rope if even a minor detail is subject to question.

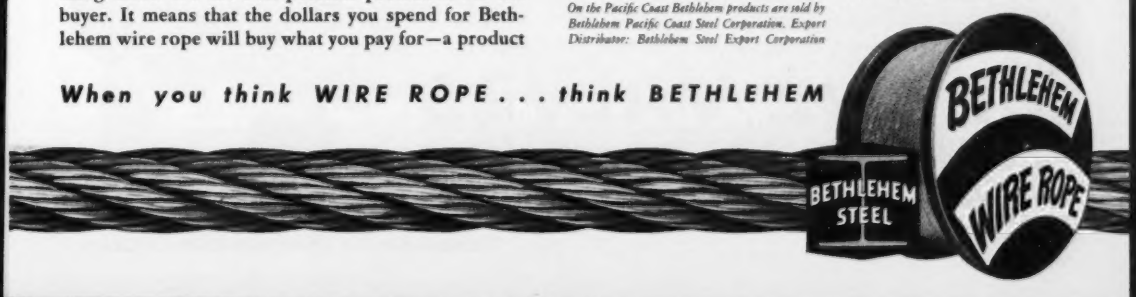
This is merely common sense. But it's also something more. It's the best possible protection for the buyer. It means that the dollars you spend for Bethlehem wire rope will buy what you pay for—a product that meets the highest standards of workmanship.

In the making of this product, nothing is left to chance. That's one of the reasons why Bethlehem rope is dependable rope . . . the kind that will serve you well in the toughest sort of going.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

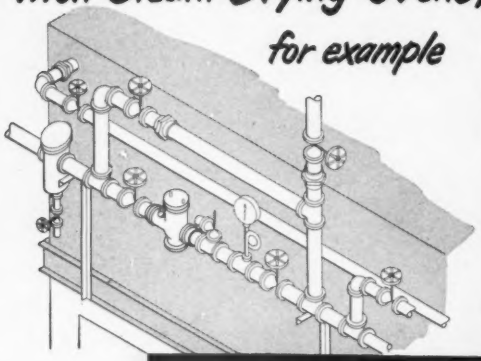
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

When you think WIRE ROPE . . . think BETHLEHEM



Are Your Pressure Regulators Doing As Well?

...on Steam Drying Ovens, for example



THE INSTALLATION

In steam supply line to battery of 2 drying ovens at Ferro Chemical Corporation, Bedford, Ohio. Ovens individually controlled by thermostatic valves.

THE HISTORY

Specifications called for a valve to reduce initial steam pressure of 70 psi to 13 psi, and to maintain reduced pressure automatically without significant fluctuation whether one, or both, or neither oven is operated. Ovens to be operated at same or different temperatures, depending on process requirements.

Specifications were met with one No. 960 Crane Pressure Regulator, properly selected for capacity, and installed with adequate drainage of condensate.

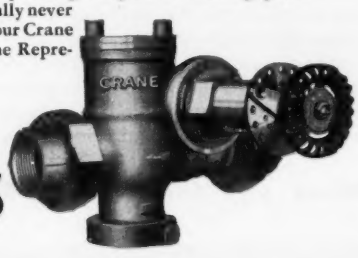
In service now more than 5 years without interruption, Crane Pressure Regulator is giving complete satisfaction. Working like new; maintenance cost to date: zero. Remarkably simple to adjust.

VALVE SERVICE RATINGS

SUITABILITY:	Does everything claimed for it
MAINTENANCE COST:	None; working like new
CORROSION-RESISTANCE:	Steam only - corrosion no problem
SERVICE LIFE:	In 5 years; no sign of wear
OPERATING RESULTS:	No fluctuation of oven heat
PRICE:	Good buy
AVAILABILITY:	Regular Crane item

THE VALVE

Crane No. 960 Brass Pressure Regulator reduces 250-Pound steam or air inlet pressure up to 80%. Available for operation at any of 4 pre-set ranges within 1 to 200 pounds outlet pressure. Adjusts easily within any set operating range. All wearing parts renewable; virtually never wears out. See your Crane Catalog or Crane Representative.



The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

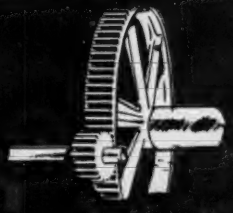
VALVES · FITTINGS · PIPE · PLUMBING · HEATING

Amscoating

The Right Way to Say Hard-facing for every Industrial Use

AMSCO TOOLFACE for metal to metal wear up to 1000 F. Deposits have high abrasion and impact resistance. All diameters bare and coated. Microstructure: martensitic steel.

AMSCO TUBE TUNGSITE coarse particles) is best suited for applications requiring highly efficient cutting qualities, for hardfacing earth working and drilling equipment used for cutting extremely hard compositions, for hardfacing applications requiring a serrated edge and hard-facing certain types of earth working equipment or parts subject to extreme abrasion.



AMSCO HF-60 for moderate impact and abrasion and has outstanding weldability particularly for vertical applications. All diameters, coated only. Microstructure: martensitic steel.

AMSCO FARMFACE or AMSCO CHROMEFACE for farm or industrial use. Excellent resistance to low stress sliding abrasion. All diameters, bare and coated. Microstructure: a high chromium austenitic iron containing manganese and silicon, and consisting of hard chromium carbides in a matrix of austenite.

AMSCO No. 217 for abrasive service up to 1000 F. All diameters, bare and coated. Microstructure: an air hardening martensitic iron alloy containing chromium and tungsten.

AMSCO HF-40 for severe abrasion, moderate impact. Deposits have excellent weldability. All diameters, coated only. Microstructure: martensitic cast iron.

AMSCO AIR-HARDENING for abrasion and severe impact. Deposit can be forged to sharp edge without loss of hardness. All diameters, bare and coated. Microstructure: martensitic steel.

AMSCO AW-79 will meet most requirements for better control of wear where abrasion and impact are important factors—plus all the advantages of automatic welding. Especially suitable for rebuilding and hardfacing tractor rollers, steel wheels, sheeting rolls, dredge pins, as well as dozens of other automatic applications. 1/16" and 5/64" in 22½" ID., 100 lb. coils.

AMSCO V-MANG, bare or coated, for build up and repair on manganese steel castings exposed to impact; work hardens—1/16", 5/64", 1/8". Microstructure: austenitic manganese steel.

AMSCO CO-MANG, coated only, for build up and repair of manganese steel castings exposed to severe impact. Deposit has excellent impact resistance, work hardens—1/8", 5/32", 3/16", 1/4". Microstructure: austenitic manganese steel.

AMSCO TUNGROD (fine particles) is best suited for applications requiring highly efficient cutting qualities, for hardfacing earth working and drilling equipment used for cutting extremely hard surfaces or formations, for hardfacing applications requiring a thin edge or small point, for hardfacing certain types of equipment or parts subject to extreme abrasion.

AMSCO ECONOMY HARDFACE "C" for abrasion resistant service and severe impact. All diameters, coated only. Microstructure: martensitic steel.

AMSCO No. 1 and AMSCO No. 6 for combination of corrosion and abrasion or for 1000 F service and above. No. 1 has greater abrasion resistance; No. 6 is tougher and can be machined. All diameters, bare and coated. Microstructures: No. 6 contains an eutectic carbide mixture in a solid solution matrix, while No. 1 contains large hard wear-resistant chromium carbide crystals scattered through a solid solution matrix.

AMSCO No. 459 for severe abrasion, mild impact. Excellent abrasion resistance. All diameters, bare and coated. Microstructure: martensitic cast iron containing chromium and molydenum, consisting of hard carbides, austenite and martensite.

To get the right answer, detailed analyses, and other pertinent information, concerning your wear problem, write for catalog 650W or contact your nearest Amsco Distributor.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que. Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

NEW

ALL-STEEL

DODGE-TIMKEN PILLOW BLOCKS

Rugged!

Compact!

HERE are the bearings for industry's toughest jobs—in the most compact and rugged "package."

High radial and thrust capacities. Stamina to take heavy shock loads. All-steel construction that packs this load-carrying capacity into less weight and less space than ever before.

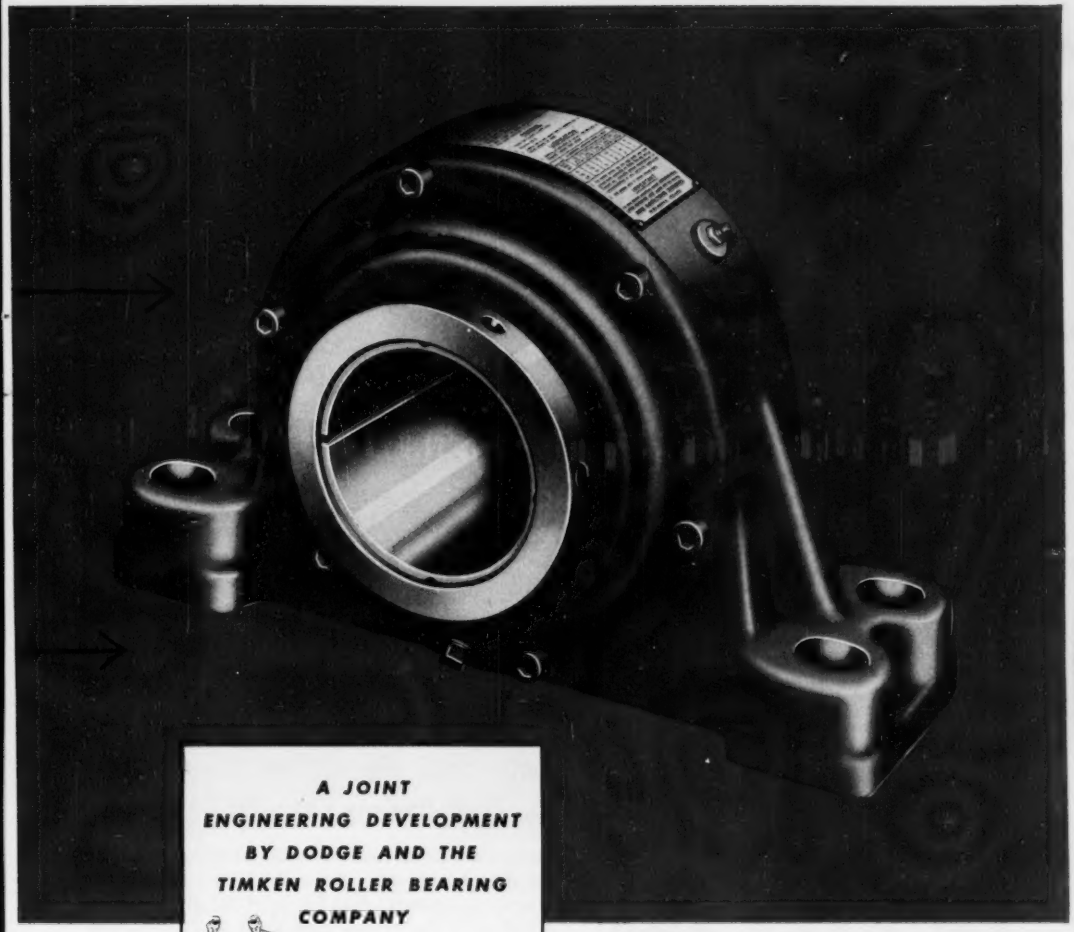
This brilliant achievement has been accomplished through pooling the engineering resources and bearing-building experience of Dodge and Timken. This new line so completely fills a need that engineers are already specifying "Dodge-Timken All-Steel" for some of America's heaviest machinery and largest industrial projects.

Completely assembled, permanently adjusted, lubricated and sealed at the factory, these All-Steel pillow blocks are shipped ready to go to work—wherever in industry the going is tough!

For detailed information and delivery dates write to Dodge, or call your Dodge Distributor.

DODGE

CALL THE TRANSMISSIONEER your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

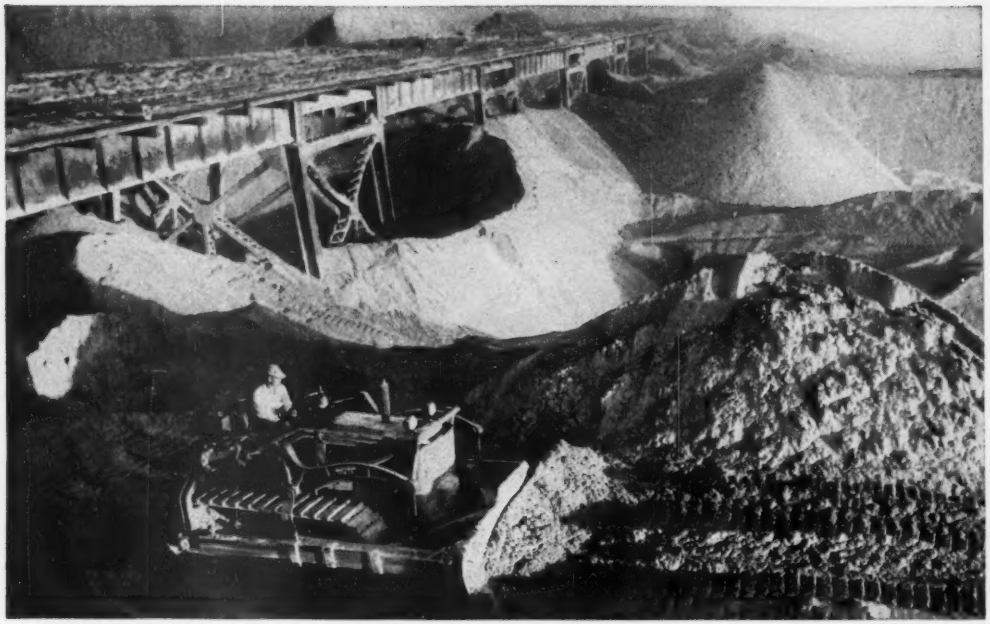


A JOINT ENGINEERING DEVELOPMENT BY DODGE AND THE TIMKEN ROLLER BEARING COMPANY

SHAFT SIZES: $2^{15}/_{16}$ to 10 in.

- All-Steel construction
- A new Timken bearing design
- High radial and thrust capacities
- Compact—minimum dimensions
- Minimum weight; maximum strength
- Fully self-aligning with spherical outer race
- Both expansion and non-expansion types
- Adapter mounting, proven through the years
- Double piston ring seals
- Sealed both on and off the shaft
- Fully assembled, permanently adjusted, lubricated and sealed at the factory

DODGE MANUFACTURING CORPORATION, 3100 Union St., Mishawaka, Indiana



KEEPER OF THE STOCK PILE is a fast, power-packed TD-14A—one of many International models used to move the most material at the lowest possible cost.

King of the Phosphate Mountain

International crawler levels off both stock pile and operating costs for Davison Chemical Co.

The operator heads his International crawler into the huge phosphate stock pile and lets 'er go. He hits the mountain of mineral and leaves it flat behind him, marked with the tracks that show a TD-14A has passed.

At the great phosphate mines near Barton, Florida, the Davison Chemical Co. knows that rugged International power pays off in volume of work done and economy of operation. Besides the TD-14A on the stock pile, another TD-14A and a Big Red TD-24—both with winches as well as bullgraders—strip off overburden in the pits and string pipe for flushing phosphate to the plant.

International crawler tractors can serve you, too, with more payload moved per day at less cost per ton.

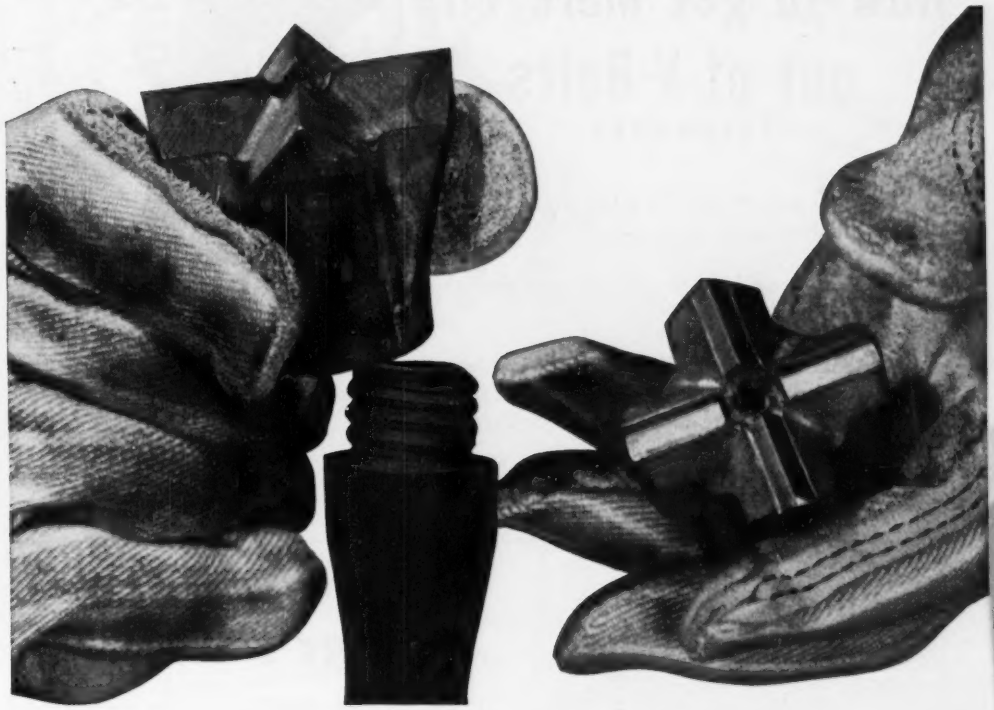
Check with your friends who already own International power. Ask your International Industrial Distributor for the details on the whole International line, and on the ready service he offers, in his shop and in the field. Get the whole low-down—and you'll go International from then on in!

INTERNATIONAL HARVESTER COMPANY
CHICAGO 1, ILLINOIS

INTERNATIONAL
POWER THAT PAYS

INTERNATIONAL HARVESTER

Change to the most economical bit type as the ground changes—RIGHT ON THE JOB!



Both TIMKEN® rock bit types fit the same drill steel

YOU'LL save drilling time, cut labor costs by using interchangeable Timken® rock bits on the job. Drillers can quickly change from multi-use to carbide insert bit, *right on the job!* Both types fit the same drill steel.

Use Timken multi-use bits for ordinary ground. With correct and controlled reconditioning, they'll give you the lowest cost per foot of hole when full increments of steel can be drilled.

When you run into hard, abrasive ground, change to Timken carbide insert bits. They're the best bet for maximum speed, constant-gage holes, small diameter blast holes and very deep holes.

With both Timken rock bit types on hand, you'll always have the right answer to every drilling problem.

Timken carbide insert bits and multi-use bits are interchangeable in each thread series. And both types of Timken rock bits give you these 3 big advantages: 1) made from electric furnace Timken fine alloy steel, 2) threads are not subject to drilling impact because of the special shoulder union developed by the Timken Company, 3) quickly and easily removable.

Call upon the 20-years' experience of our Rock Bit Engineering Service for help in selecting the best bits for *your* job. Write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

Timken threaded multi-use rock bit

Timken threaded carbide insert rock bit

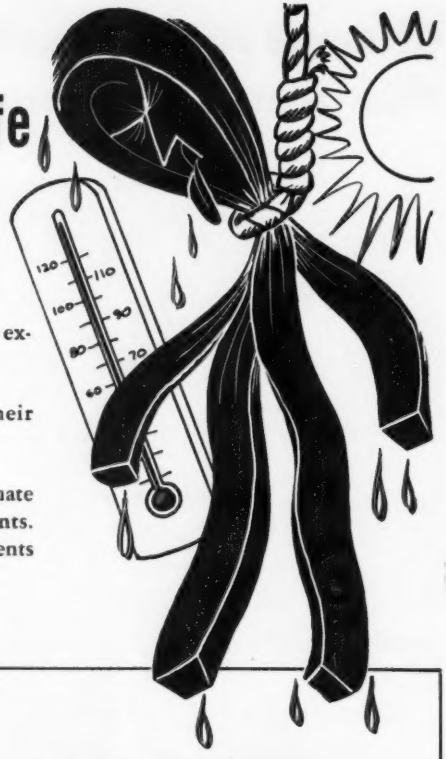
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

your best bet for the best bit . . . for every job

How to get More Life out of V-Belts

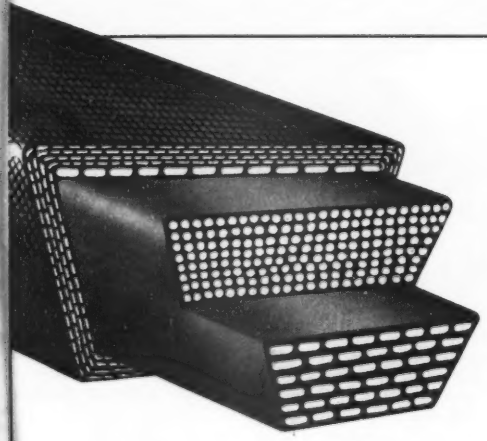
(STORAGE)



DON'T store V-Belts in a hot dry room or expose to the direct rays of the sun.

DON'T hang belts in such a way that their shape will be distorted.

DO specify and store *Bull Dog V-Belts* in adequate supply for your normal replacement requirements. With Bull Dogs on the job "normal" replacements are few and far between.



Your BWH distributor will be glad to show you how Bull Dog V-Belts have the covers, the cords and the compounds to cut *your* belting costs. Call him today.

HERE'S WHY

Their DURABLE COVERS withstand the severe wearing action of the sheave while sealing the belt against grease, dirt, moisture.

There's MINIMUM STRETCH due to a new, exclusive technique which results in fewer takeup adjustments, reduced slippage, longer belt life.

There's a STRONG, SPECIALLY ENGINEERED CORD SECTION with high tensile strength, increased load carrying capacity, ability to absorb shock loads.

The belt TAKES HEAVIEST FLEXING because BWH quality-controlled compounds run cooler and do not crack or deteriorate under severe flexing.

BWH
DEPENDABLE RUGGEDNESS

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Warehouse Stock: 111 N. Canal St., Chicago, Illinois **Distributors in all Principal Cities**

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U. S. A.

People *will talk*

開密克幫我們發展工業。
"Chemico helped us develop our industry"

"Chemico" heeft ons meer gegeven dan wij verwachtten.
"Chemico gave us more than we expected"

«كيميكو» ركّبه
"It's designed by Chemico"

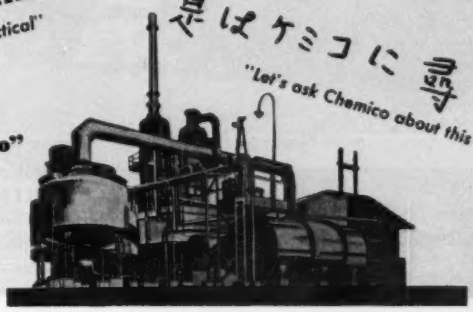
"केमिको" ने सारा काम किया।
"Chemico did the whole job"

"Chemico" comprend nos problèmes.
"Chemico understands our problems"

"CHEMICO" SABE SE É PRÁTICO.
"Chemico knows whether it's practical"

ケミコに尋ねよう!
"Let's ask Chemico about this"

La reputación de "Chemico" nos ha persuadido.
"Chemico's reputation sold us"



When our representatives travel to the far corners of the earth, they find that word of Chemico's activities has gone before them.

Yes, people *will* talk . . . and carry the news of Chemico accomplishments in the design and construction of plants for the production of heavy chemicals: fertilizers for India, Mexico, the Philippine Islands and Egypt; sulfuric acid for Canada, England, Formosa and Brazil; urea for Japan; sulfur recovery for Colombia; pickle liquor recovery for the Union of South Africa, to name a few. And naturally these are in addition to numerous large-scale projects in the United States.

Chemico has created, designed and erected more than 800 installations during the past 37 years that have given people much to talk about. That's why "Discuss it with Chemico" has become a byword of those who need new facilities or additional plant capacity to meet the world's ever-expanding heavy chemical needs.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

CABLES: CHEMICONST, NEW YORK

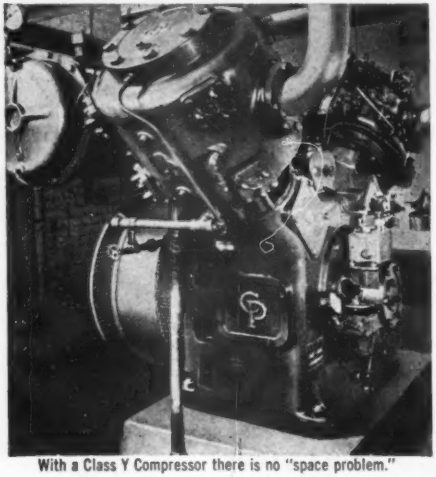
TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICA CYANAMID (PTY) LTD., JOHANNESBURG

Chemico plants are profitable investments

CC-856

Wherever air is needed

CP-315 Portable Compressor supplying air for drilling on bulk sampling operation.



With a Class Y Compressor there is no "space problem."

Built for dependable operation in any location, time-tested CP PORTABLE AIR COMPRESSORS have Gradual Speed REGULATOR that adapts engine speed to air demands, minimizing wear and assuring maximum operating economy.

CP Portable Compressors are available in gasoline and Diesel-driven models ranging from 60 cfm to 600 cfm.

* * *

Only a simple foundation is required for the exceedingly compact CLASS Y COMPRESSOR, which is shipped intact as a "package" requiring only external connections.

Not only is the Class Y easy and inexpensive to install, but it may readily be moved, intact, to another location whenever desired. Yet it is built for continuous, heavy-duty service, with CP features that assure high efficiency and low maintenance.

Available in sizes from 75 hp to 250 hp; 500 cfm to 1663 cfm; with direct-connected, flange-mounted synchronous or squirrel cage motor. Also with belted and coupled motors.

CP Fiftieth ANNIVERSARY

CHICAGO PNEUMATIC TOOL COMPANY

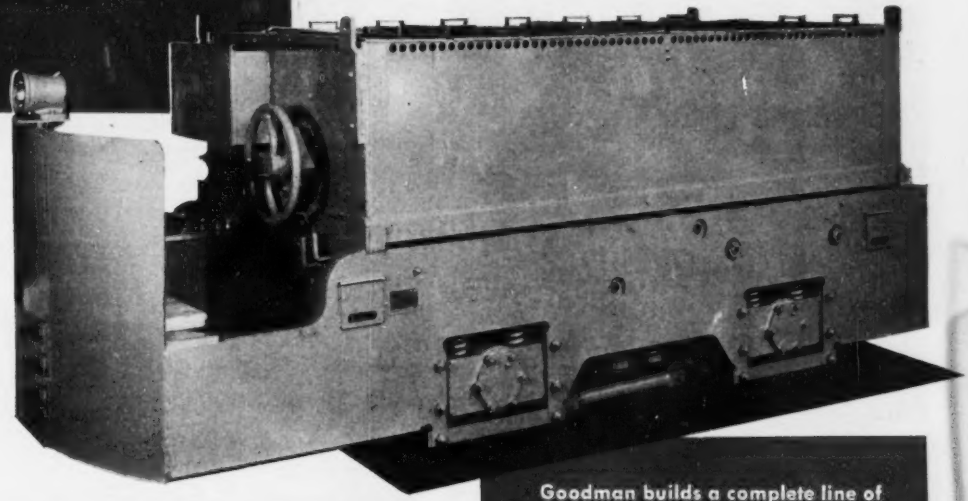
General Offices 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

- SAFE OPERATION
- CONTINUOUS SERVICE
- LOW MAINTENANCE
- LONG LIFE

YOU GET THEM ALL IN

Goodman METAL MINE LOCOMOTIVES



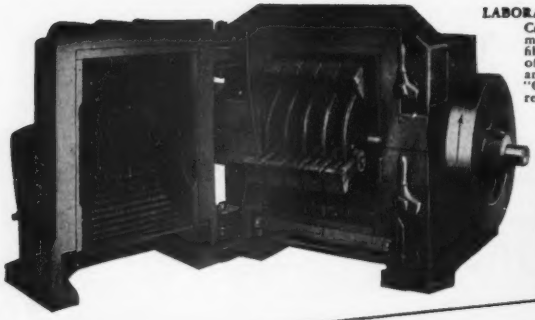
Each Goodman locomotive is recommended for a particular job only after a thorough study of mine requirements, now and in the future.

So dependable is Goodman locomotive performance, so rare the interruptions of haulage, that production every shift is at its maximum. Rugged construction keeps maintenance and depreciation charges to a minimum.

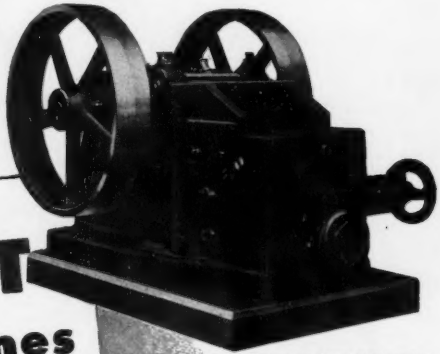
Goodman builds a complete line of trolley and storage battery locomotives. Illustrated here is a 4-ton (chassis weight) storage battery unit for 36" gauge. Over-all dimensions: length 12' 8", width 56"; height (over battery box) 59". Wheelbase is 54". A feature is slow speed armatures with single reduction gearing. Each of its two motors is 19 hp at 80 volts; rated drawbar pull is 2,000 lbs. at 4½ mph.

JUST PRINTED: Catalog CH-521 describing in detail the Goodman line of Metal Mine Locomotives. Your request will bring you a copy promptly.

Goodman MANUFACTURING COMPANY
HALSTED STREET at 48th • CHICAGO 9, ILLINOIS

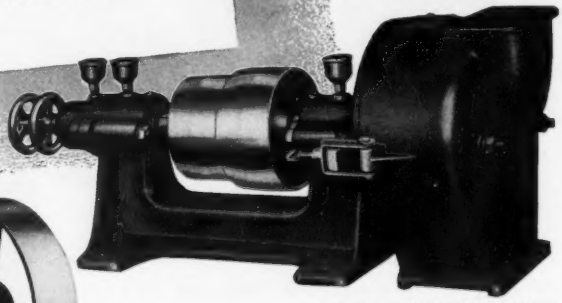


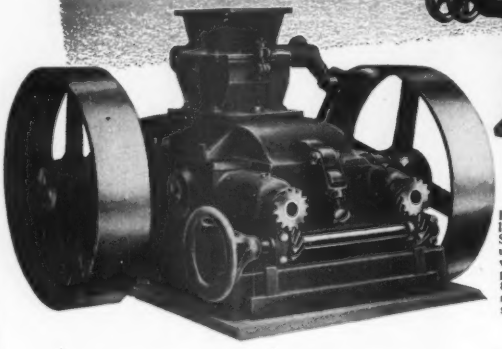
LABORATORY SWING-SLEDGE MILLS
Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.



STURTEVANT
Laboratory Machines
Assure Quality of Products
Fast - Economical - Accurate

LABORATORY JAW CRUSHERS
Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.





LABORATORY CRUSHING ROLLS
First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from ½ in. to 20 mesh — and for the 12 x 12 size from ¾ in. to 20 mesh.

LABORATORY SAMPLE GRINDER
Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

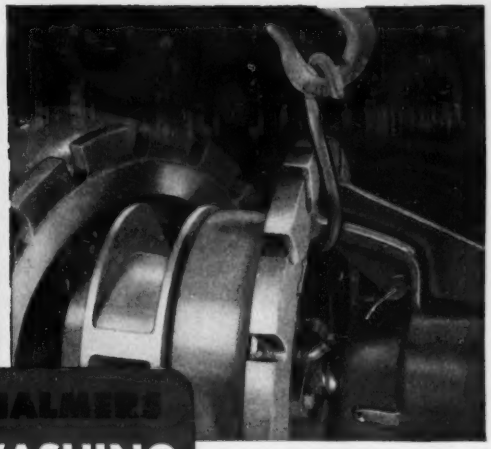
Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

STURTEVANT MILL COMPANY
101 CLAYTON STREET, BOSTON 22, MASS.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS •

QUICK, EASY DISASSEMBLY MEANS

Low Service Cost



1. Disconnect drive, loosen casing bolts and lift bolt assembly from slot. Bolt, nut and washers are still connected for easy reassembly.

ALLIS-CHALMERS
COAL WASHING PUMP

2. Swing out rotating element. Neither suction nor discharge piping is disturbed. All wearing parts are fully accessible for inspection or servicing.

Back in Service in less than a Half Hour

ALLIS-CHALMERS

Coal Washing Pump

Only 5 Wearing Parts

Shaft sleeve, impeller, casing, two wear plates. All easy to handle and easy to replace.

YOU CAN SEE for yourself how quick and easy it is to service an Allis-Chalmers Solids Handling Pump. Fast servicing like this plus long runs between servicing keeps your pumping costs low.

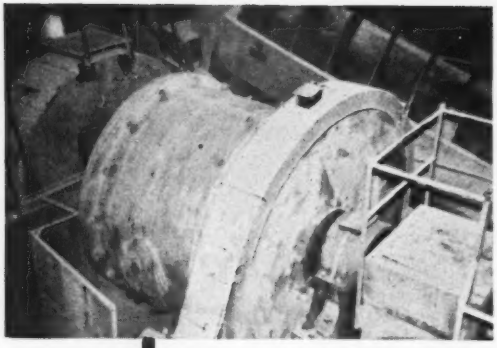
You get long life from Allis-Chalmers Coal Washing Pumps, too, because they are made of special hard *Allisite* alloy . . . because they have thick sections and heavy parts throughout . . . and because they are application engineered by specialists who know coal washing problems and how to solve them. Allis-Chalmers can supply the complete pumping unit — pump, motor, drive and control — of matched components from one reliable source with one guarantee of satisfaction.

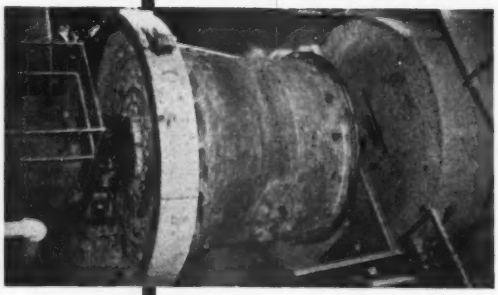
Get complete information on Allis-Chalmers Solids Handling Pumps from your nearest Allis-Chalmers Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, asking for Bulletin 08B6381. A-3781

Allisite is an Allis-Chalmers trademark.

ALLIS-CHALMERS A-C

Grinding Fluorspar with... MARCY MILLS





Like many other metals and non-metals... molybdenum, nickel, copper... most of the fluorspar produced in the United States gets its grinding treatment by Marcy Mills. In the following fluorspar operations Marcy Grate Discharge Ball Mills and Open End Rod Mills are used:

Alcoa Mining Co., Rosiclaire	**2 No. 54**
General Chemical Corp., Deming	**1 No. 55**
Ozark-Mahoning Mining Co., Jamestown	**1 No. 65½**
North Park	**1 No. 64½**
	***1-4' x 10'**
Rosiclaire	**1 No. 64½**
	1 No. 65

**Marcy Open End Rod Mill used for fine crushing ahead of ball mill.*

The acceptance of the Marcy low-pulp-line, rapid-circulation-of-mill-content principle of grinding is proved by the universal use of Marcy Grate Discharge Mills... and the many repeat orders based on output and low-cost-per-ton performance.

Let our engineers show you proof... actual operating data for all kinds of grinding and classification problems.

The Mine & Smelter Supply Co.

DENVER 17, COLORADO

OFFICES IN SALT LAKE CITY, EL PASO, 1745 BROADWAY, N. Y. C.

REPRESENTATIVES IN FOREIGN COUNTRIES

Get maximum safety and service life at minimum cost

WITH JOY ELECTRICAL CONNECTORS

CONVENIENT • FLEXIBLE • ECONOMICAL

RIGHT ... Tap-off made with Joy Connector. Circuit can be opened or closed at will—speedily, safely, neatly—simply by engaging or disengaging male plug.

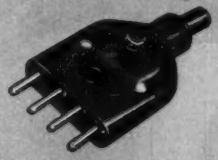
WRONG ... Photo taken in lead mine shows how extension was wired into main line and later carelessly cut off, thereby creating a hazardous condition.

OVAL STYLES
Also available with 3 contacts

Female Portable

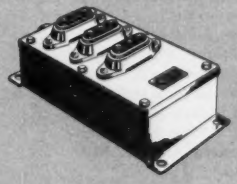
Female Wall Receptacle

Male Machine Receptacle



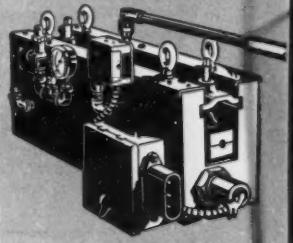
Male Portable

GANGS
#F137 Gang



For power tap-offs from single feeder to a variety of operating equipment. Available in 2, 3, and 4 outlet styles. Input fitting threaded for conduit.

CABLE JACKET VULCANIZERS
Electrically Heated



Electric immersion type heaters generate steam for heating mold. Heat control is fully automatic. Has safety "pop-off" steam valve. Available in five standard sizes.

MOLDS AVAILABLE FOR ALL STANDARD CABLE SIZES

Dangerous, makeshift wiring installations can be eliminated with the use of Joy Electrical Connectors. Of one piece molded Neoprene construction, Joy Connectors are watertight and shatter-proof—impervious to adverse climatic or mining conditions. Oils, acids, alkalies or moisture have little effect on their life span or conducting efficiency.

All Joy Connectors are supplied with lengths of cable as specified by the customer. Each Connector is permanently attached to its cable through "taper-neck" vulcanization—a process that provides additional strength at this vital point. When fully engaged, contacts are completely enclosed in a waterproof Neoprene housing.

For an easy and economical solution to your wiring problems try Joy Electrical Connectors. A wide variety of types and styles is available—each designed for maximum safety, economy, and trouble-free service.

An attractive new Joy Bulletin, No. MC-109, available upon request, describes this equipment in detail.

Write for Bulletins, or *Consult a Joy Engineer*

WAD ME 3884

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

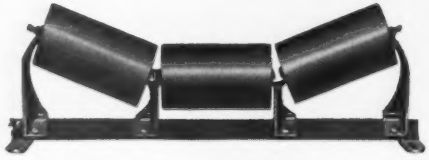
a big "hit" below the belt!

Nearly everyone realizes the advantages of belt conveyors for low-cost transportation of bulk materials. But what goes on below the belt is, perhaps, too often taken for granted. Certainly, the belt idler, more than any other piece of equipment, is responsible for the low cost of belt conveying per ton of material handled.

That's why Rex® Idlers are so often specified. Rex has been the leader in idler design and construction for over 25 years and sets the standard that others are working toward.

An idler must "keep rolling." If it freezes up, the belt will quickly wear through the roll, leaving sharp edges to cut your belt. The most common causes of idler "freeze-ups" are grit and dirt entering the bearings and build-up of material underneath the roll. To keep your Rex Idlers rolling, all you have to do is *keep your deck plates clean.* This will prevent material from building up on the rolls. The Rex Triple Labyrinth Grease Seal does the rest. The grease is there only to keep out dirt and grit, not to lubricate. With the special Rex seal design, the grease stays in . . . the dust stays out.

Remember, your idlers are the backbone of your entire belt conveyor. Don't gamble. Insist on Rex and be sure of a trouble-free performance year after year. For all the facts call your nearest Chain Belt Field Sales Engineer or write for Bulletin 51-81. Chain Belt Company, 4679 W. Greenfield Avenue, Milwaukee 1, Wisconsin.



For over 25 years Rex Idlers have been recognized as leaders in the field of idler design. Now Rex again leads the way with the flexible grease line. Note the accessible, protected location of the fitting. Extension of tubing to far side can easily be done in the field without special tools. Flexible sections hug the inside of the base.

CHAIN BELT REX COMPANY ®

Chain Belt COMPANY OF MILWAUKEE

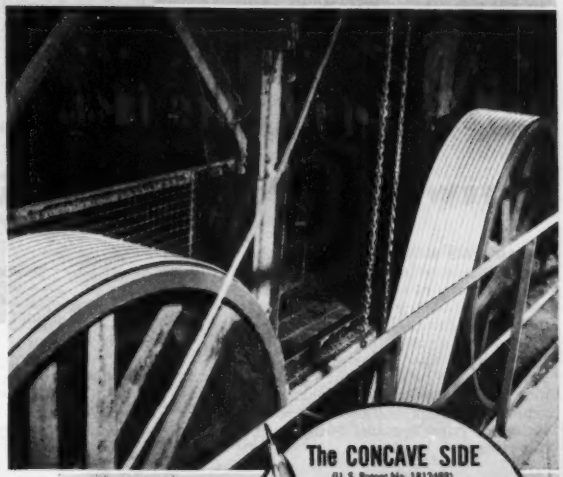
Atlanta • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland
Dallas • Denver • Detroit • El Paso • Houston • Indianapolis • Jacksonville
Kansas City • Los Angeles • Louisville • Midland, Texas • Milwaukee • Minneapolis
New York • Philadelphia • Pittsburgh • Portland, Oregon • Springfield,
Mass. • St. Louis • Salt Lake City • San Francisco • Seattle • Tulsa • Worcester

Distributors located in principal cities in the United States and abroad

See for Yourself WHY

Gates Vulco Ropes Wear Longer

These tube mills at the Missouri Portland Cement Co., Kansas City, Mo., were formerly driven by long flat belts. Belt dressing, used to control slipping, picked up dust and built up an irregular coke on the pulleys —causing terrific tension on the belts and shock loads on the bearings. The bearings burned out; belts snapped. Replaced in 1946 by the Gates Vulco Rope Drive shown, belt failures have been eliminated and the drive installation is much more compact.



Make this Simple Test

Take any V-belt that has *straight* sides. Bend that V-belt while you grip its sides between your fingers and your thumb. You will *feel* the sides of the belt *bulge out*—as shown in figure 1-A, below.

Clearly, that outbulge forces the sides of the belt to press *unevenly* against the V-pulley —and this concentrates the *wear* where the bulge is greatest.

Now, make the same test with the belt that is built with the Concave Sides—the Gates Vulco Rope.

Figures 2 and 2-A show clearly what happens when you bend a Vulco Rope. Instead of *bulging*, the precisely engineered Concave Sides merely *fill out* and become perfectly straight. This belt, when bent, precisely fits its sheave groove.

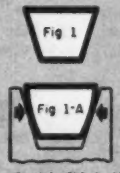
Because there is *no bulging*, the sides of the Gates Vulco Rope always grip the full face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

When you buy V-belts, be sure to get the V-belt with the Concave Sides– –the Gates Vulco Rope!

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

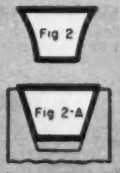
What Happens When a V-Belt Bends

Straight-Sided V-Belt



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

Gates Vulco Rope with Concave Sides



The Concave Sides Fill Out to a Precise Fit in the Sheave-Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley — Uniform Wear — Longer Life!

CS-528-B

Gates VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

V-Belts — Hose Molded Rubber Goods for industry

World's Largest Maker of V-Belts

HOW THE EASTON SIDE-DUMP IDEA CAN MEET YOUR EXACT REQUIREMENTS!

To double your capacity for a long off-highway haul you might want to hitch a dump trailer to a dump truck. How could the front unit dump *except* to the side? It *couldn't* dump any other way!

When the containers dump to the side *any* combination of units is possible. Side-dump *flexibility* lets you plan a haulage fleet to meet your exact requirements, regardless of load, speed, grade or distance. That's why you see so many *different* EASTON side-dump combinations in off-highway service!

Also, with every EASTON side-dump, you eliminate the need for costly backing and turning at the dumping point. You roll up, dump, and roll on. Your driver *sees where he is going* at all times!

For real haulage economy remember that EASTON side-dumps may be used with any make of off-highway truck or tractor. For specific side-dump recommendations write to the address below.

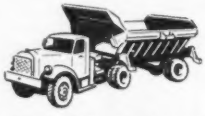
A FEW VARIATIONS OF THE EASTON SIDE-DUMP IDEA:

These and other EASTON side-dump combinations, with capacities ranging from 14 to 45 tons, are providing a smooth economical flow of material in mines, quarries and other off-highway hauling operations throughout the world. EASTON engineers will welcome the opportunity to discuss the application of side-dump truck bodies and trailers to meet your specific haulage requirements.

Pan Type Truck Body for shuttle service to a fixed point on grade work against the load.

Drop Door Truck Body hydraulic dump, for versatile all-around hauling, free dumping at any point.

Drop Door Trailer with gooseneck frame, hydraulic dump, for versatile all-around hauling, free dumping at any point.

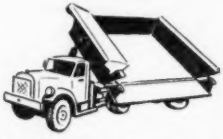


Pan Type Trailer for big payloads to a fixed point in shuttle service over moderate grades.

Drop Door Truck Body with drop door trailer, hydraulic dump, for big payloads over long hauls. Back mounted body provides extra traction.

Lift Door Truck Body for heavy loads against steep grades to a fixed dumping point.

Pan Type Tandem Trailer for extra large capacity over long distance with fairly level roads.



Drop Door Trailer, hydraulic dump, for big payloads over moderate grades, dumping at any point.

Dual Bodied Trailer, pan type, for big payloads to a fixed point, each body dumping separately.

Drop Door Tandem Trailer, hydraulic dump, for extra large payload, long haul over fairly level roads, dumping at any point.

Pan Type Truck Body with pan type trailer, for large payload to a fixed dumping point with back mounted body providing extra traction.

B-1054

EASTON SIDE-DUMPS

EASTON CAR & CONSTRUCTION COMPANY • EASTON, PA.

THE IMPROVED

Exide-Ironclad

BATTERY

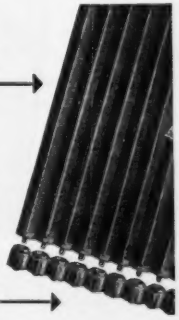
GIVES you more . . . SAVES you more

It gives you more of everything that adds up to top performance, long battery life . . . saves you more through low over-all costs. Outstanding new features, including the polyethylene insulating tube sealer, *more than ever before*, make Exide-Ironclad YOUR BEST POWER BUY . . . AT ANY PRICE.

HERE'S WHAT YOU GET

Rapid, high production haulage, more trips per shift . . . High maintained voltage, with uniform speed to end of shift . . . High availability . . . Low operating costs . . . Low maintenance costs . . . Low depreciation costs . . . Safety from hazards of fire and fumes.

AND HERE'S WHY



IMPROVED POSITIVE PLATE CONSTRUCTION. The long-life grids now contain SILVIUM—an alloy of silver, lead and other components—which makes them highly corrosion-resistant.

NEW POLYETHYLENE INSULATING TUBE SEALER of acid-proof, non-corroding plastic. It fits snugly into slotted tubes of positive plates, and reduces loss of active material. Even the small sediment deposit of the past is reduced 50%. Thus more active material remains available, and the high battery capacity is maintained for a longer working life.

PLUS THESE EXTRAS

IMPROVED NEGATIVE PLATES for higher electrical efficiency.

NEW SEALING COMPOUND provides permanent seal between jar and cover.

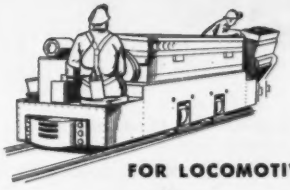
SEAMLESS SHOCK-PROOF JAR, of high-quality rubber. A scientifically selected combination of tensile strength and elongation provides a sturdy jar built for long-life and heavy-duty service.

NEW UNBREAKABLE PLASTIC VENT PLUGS of polyethylene.

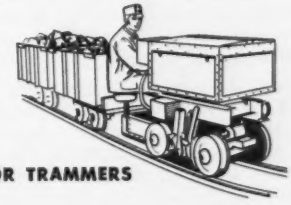
TYPES, SIZES AND CAPACITIES for battery-electric mine haulage units of every make.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

1888
DEPENDABLE BATTERIES FOR 64 YEARS
1952



FOR LOCOMOTIVES



FOR TRAMMERS

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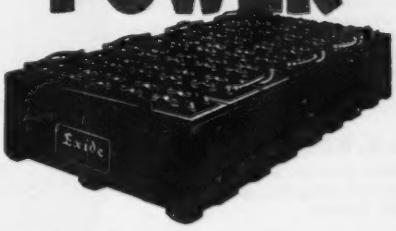
Exide-Ironclad

IS YOUR BEST POWER BUY

. . . AT ANY PRICE

POWER



"EXIDE-IRONCLAD" and "SILVIUM" *Reg. T.M. U.S. Pat. Off.*

WILFLEY
centrifugal PUMPS

30 acres 2 miles

• ***Wilfley Special High Head Sand Pumps*** play an important role in the successful reclamation program of the Hawaiian Commercial & Sugar Co.

• Each year, at the Puunene Mill, 30 to 40 acres of useless, sandy waste land are transformed into productive ground for sugar cane cultivation.

• Soil, removed from mechanically harvested cane by washers, is settled to a sludge of 15% to 25% solids. This sludge, together with a sludge of repulped filter cake, is pumped to the diked waste area. When dry, there remains a 2 to 3-ft. layer of reclaimed cultivable topsoil over the coral sands.

• WILFLEY Pumps, operating on a 24 hour-a-day, trouble-free schedule perform the tremendous task of delivering 300- 500 G.P.M. of cane washer wastes through 2 miles of 6" pipeline to the reclamation area. As a result, wastes which formerly presented a costly disposal problem, are now converted into revenue-producing land.

Wilfley Special High Head Pumps in operation at the Puunene Mill of the Hawaiian Commercial & Sugar Co

Buy rugged, heavy-duty Wilfley Pumps whenever the job calls for the efficient and economical handling of sludges, slimes, slurries or sands. The new WILFLEY Model "K" Centrifugal Sand Pump, embodying many important mechanical improvements, delivers higher efficiencies, stepped-up production, worthwhile power savings and lower operating costs. Easy interchangeability of wear parts. Low maintenance costs. Every application individually engineered. Write or wire for complete details.

A. R. Wilfley & Sons, Inc.
Denver, Colorado, U.S.A.
New York Office: 1775 Broadway, New York City

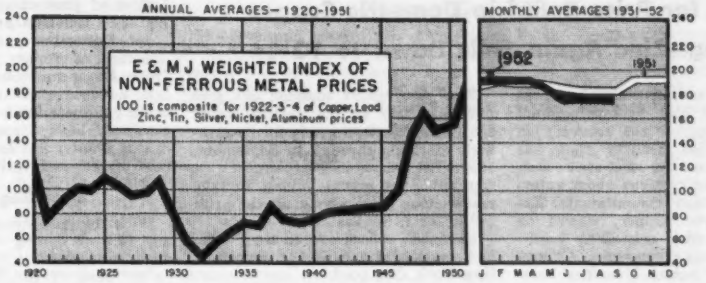
Buy WILFLEY for cost saving performance

Companion to the famous WILFLEY Acid Pump

Upper: Reclaimed land under cultivation
Center: Diked reclamation area
Bottom. Waste land to be reclaimed

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1951
E & M J WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead Zinc, Tin, Silver, Nickel, Aluminum prices
MONTHLY AVERAGES 1951-52
1952
1951
J F M A M J J A S O N D

MARKETS

"Jungle law," says one observer, rules the zinc market, where some seaboard sellers, under pressure of mounting stocks and foreign metal, cut their price to 13½¢. Other producers held to 14¢, did a substantial business with stability-minded consumers. GSA stockpile buying may support the market, but the immediate outlook for zinc is not strong.

When London's free lead market reopened Oct. 1, prices dropped at once to about the equivalent of 15½¢ per lb., U.S. It seems likely that more foreign lead will soon be headed toward U.S. markets.

Copper consumers, sensing that 24½¢ is too low for domestic copper, still rush to buy at that level. It's doubtful, however, that the 36½¢ price of Chilean copper can be held much longer, barring strikes or slow-downs.

Zinc's weakness eased the *E&MJ* index of nonferrous metal prices to 178.59 for September from the August level of 178.70. In September a year ago, the index stood at 186.15.

•

LABOR

Mine, Mill will launch another organizing drive, as soon as they settle with Kennecott. The last one never got off the ground.

We hear Reid Robinson, former Mine, Mill president, is selling kitchen utensils in southern California. Doing well, too.

•

AT HOME

Although there's a dip coming in demand for metals, the long-term outlook is for increased demands, perhaps beyond anything yet known.

White Pine's mind is made up on plant and processes. Using low-head loading and conveyors in the mine, plus conventional practices in mill and smelter, this $57-million Michigan project will mill 10,500 tons of ore daily, produce 75-million lb. of copper yearly.

Widespread industry support seems likely for E. H. Snyder's plea for national buffer stocks, as against the Paley Report's international buffer stockpiles. Tied to some price index, the Snyder stockpile would release, or buy up, metal as prices fluctuated.

Look for higher prices for aluminum, long-range, because of: 1, competitive bidding for blocks of cheap power; 2, high freight costs in the line from mine to consumer; 3, probable higher bauxite costs.

•

ABROAD

Get in line, if you want to prospect in Newfoundland. Now active, or interested, up there are: American Zinc, Selection Trust, Sogemines (Belgium), Newmont, St. Joe, National Lead, New Jersey Zinc, Reynolds Metals, Cyprus, Rothschild, Frobisher, and Falconbridge.

We hate to mention it, but nobody is really paying attention any more to the International Materials Conference and its entitlements.

MARKETS—Trends and Prices

Pressure for Price Relief in Domestic Copper Increasing—Zinc Again Sells Down to 13½¢

CONSUMPTION OF NONFERROUS METALS continued at a high rate throughout September. Despite the recovery in general business activity that has taken place since the steel strike ended, buyers were cautious about entering into long-term commitments. Excepting domestic copper, viewed as underpriced under prevailing conditions, fabricators are pursuing a "buy-as-you-need-it" policy. Unsettled business conditions in Europe, along with uncertainty over the outcome of the election in this country, naturally would make buyers cautious.

Outstanding in price developments was the continued unsettlement in zinc. This resulted in another dip in the price and caused the *E&MJ* index of nonferrous metal prices to decline from 178.70 in August to 178.59 in September. In September a year ago the price index stood at 186.15. Primary aluminum, which was raised 1¢ a lb. in the preceding month, continued at 20¢ for ingot throughout September. Spot quicksilver was higher on a temporary squeeze in the supply available for immediate delivery.

Zinc Cuts Up Again

The August statistics of the American Zinc Institute were better than generally anticipated, stocks falling slightly instead of increasing. This caused the price to steady and it moved up from 14¢ to 14⅛¢ over a period of two days. However, demand continued rather spotty. After a brief testing period at the higher level, an important custom smelter lowered its quotation to 14¢. This move only served to unsettle the market, and the same operator then went to 13½¢ to attract more business. Beginning with Sept. 22, prices varied between 13½¢ and 14¢, depending on the seller. Producers so situated that business could be done at 14¢, because of freight advantages or other considerations, reported scattered sales almost daily, which caused our averages on zinc to fluctuate over the last eight days of the month.

Smelters treating domestic concentrates were concerned over maintaining production at the mines and felt that output would suffer at a price lower than even 15¢. Those producers of metal situated in areas where foreign competition has become a factor were greatly concerned over offerings from European sources at substantially lower levels. This development, together with the gain in stocks that has occurred here in recent months, caused general uneasiness in some quarters over the outlook.

The government sounded out producers of zinc on the availability of the Prime Western grade for its strategic stockpile through to September, 1953. The move was exploratory, it was said, yet actual buying for the reserve took place soon after the price fell to the 13½¢ basis.

European sellers offered zinc to the U.S. market at around 14¢, landed in New York, duty paid.

Production of slab zinc in the United States in August was 78,167 tons, which compares with 76,930 tons in July. Total shipments (domestic, export, and government account) came to 78,435 tons in August, against 43,353 tons in July. The end of the steel strike caused the upturn in shipments. The stock on hand as August ended totaled 96,651 tons, down 268 tons from July.

Copper Allocations Off

The National Production Authority looks for some reduction in the supply of copper available for consumption in October. Allocations of domestic and foreign copper were reduced from 125,009 tons in September to 118,481 tons in October. NPA informed the Brass Mill Industry Advisory Committee that uncertainty exists about the supply of copper in the fourth quarter. Factors contributing to this uncertainty include: (1) extent of stockpile activities; (2) taking up the accumulated stock of copper in Chile; (3) the labor situation; and (4) varied prices which exist in the domestic copper market.

Actually, fabricators have been getting more copper in recent months than earlier in the year and there are strong indications that inventories are increasing. Buyers are eager for all of the domestic 24½¢ metal obtainable, because most observers agree that this price is too low and should be raised. To further confuse the pricing situation, OPS allowed Calumet & Hecla to lift its ceiling price to 27½¢, up 2⅞¢. This relief was obtained under the Capehart amendment to the Defense Production Act. It was granted on copper produced from mixed domestic ores, reclaimed metal, and secondary materials. Custom smelters said it made a bad situation in scrap worse, and they asked that OPS also grant them price relief.

Commenting on the copper situation at a dinner in honor of Robert E. Dwyer, president of Anaconda, Cornelius F. Kelley, chairman, said, "It is economically impossible to continue with advancing wages and the costs of practically every other item on the budget of production without obtaining some relief on price."

As September ended, there were offerings of copper in this country from European sources anxious to take advantage of the higher prices being paid here for foreign metal. The continued heavy demands for copper in this country has been the chief support of the world price.

Stockpiling Lead

With the government again inquiring for stockpiling lead, quotations were maintained in the U.S. market on the basis of 16¢, N.Y., with sales to consumers in good volume. Willingness on the part of producers to offer lead to the government, points to an easier supply situation.

Trading in lead resumed on the London Metal Exchange on Oct. 1. The British Ministry has announced that it is not its policy to release more than a relatively small tonnage of

Average Prices for September (E&MJ Quotations)

Copper:	
Electrolytic, domestic, refinery	24.200
Electrolytic, export, refinery	34.824
Lead:	
Common, New York	16.000
Common, St. Louis	15.800
Silver and Sterling Exchange:	
Silver, New York, per oz.	83.250
Silver, London, pence per oz.	73.000
Sterling Exchange, "Checks"	278.310
Zinc:	
Prime Western, East St. Louis	13.983
Tin:	
New York Straits	121.500
New York, 99% min. (e)	120.500
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	190.680
Antimony (E&MJ) (d)	42.470
Antimony, bulk, Laredo	39.000
Antimony, in cases, Laredo	39.500
Platinum, refined, per oz.	90.000
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	20.000
Magnesium, ingot	24.500
Nickel (f)	56.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lbs.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

lead for sale during the early months of the operation of the Exchange.

The RFC continued to dominate in sales of prompt tin and the quotation was unchanged throughout the month at $1.21½. Late in September it was announced that the Bolivians, acting through the Mercantile Metal & Ore Corp., N.Y., sold between 6,000 and 7,000 long tons of tin contained in concentrates to the RFC. The short-term contract, involving concentrate stocked at Peruvian and Chilean ports, was closed on the basis of $1.17½ a lb., f.o.b. port of shipment. This price is equivalent to that agreed upon for tin obtained earlier in the year from Malaya and other sources.

"Free" Gold Market

The free gold market was disappointed by the result of the recent meeting of the International Monetary Fund, in Mexico City. Transactions fell below those of the preceding month by at least 50%. Prices moved within narrow limits. No major increase of free market prices expected in the near future. "Pick's World Currency Report" quotes, per fine ounce, as follows:

	COINS		BARS (12.5 kg.)	
	Aug. 30	Sept. 30	Aug. 30.	Sept. 30
NEW YORK, transit	.....	.....	$37.60	$37.30
MANILA	$48.00	$48.00	36.75	36.85
HONG KONG	47.75	47.85	40.65	40.75
BOMBAY	50.00	49.55	46.80	46.00
TANGIER	51.25	50.50	37.75	37.35
BEYROUTH	50.80	50.63	37.60	37.40
PARIS	52.25	50.25	39.10	38.75
BUENOS AIRES	46.50	46.00	41.25	40.75

(*Markets continued on page 107*)

Major Metals

U. S. DAILY AND AVERAGE PRICES

Sept. 1952	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	Holiday	33.425	Holiday	Holiday	Holiday	Holiday
2	24.200	34.950	121.500	16.000	15.800	14.000
3	24.200	34.575	121.500	16.000	15.800	14.000
4	24.200	34.925	121.500	16.000	15.800	14.000
5	24.200	34.675	121.500	16.000	15.800	14.000
6	No Market	34.200	121.500	16.000	15.800	14.000
8	24.200	34.850	121.500	16.000	15.800	14.000
9	24.200	35.075	121.500	16.000	15.800	14.000
10	24.200	34.975	121.500	16.000	15.800	14.000
11	24.200	34.925	121.500	16.000	15.800	14.000
12	24.200	35.300	121.500	16.000	15.800	14.300
13	No Market	34.450	121.500	16.000	15.800	14.500
15	24.200	35.275	121.500	16.000	15.800	14.500
16	24.200	35.125	121.500	16.000	15.800	14.500
17	24.200	34.900	121.500	16.000	15.800	14.500
18	24.200	34.575	121.500	16.000	15.800	14.000
19	24.200	35.050	121.500	16.000	15.800	14.000
20	No Market	34.200	121.500	16.000	15.800	14.000
22	24.200	35.100	121.500	16.000	15.800	13.525
23	24.200	35.425	121.500	16.000	15.800	13.625
24	24.200	34.950	121.500	16.000	15.800	13.500
25	24.200	35.075	121.500	16.000	15.800	13.825
26	24.200	35.300	121.500	16.000	15.800	13.750
27	No Market	34.325	121.500	16.000	15.800	13.500
29	24.200	34.950	121.500	16.000	15.800	13.725
30	24.200	34.850	121.500	16.000	15.800	13.825
AVERAGES FOR MONTH						
Sept.	24.200	34.824	121.500	16.000	15.800	13.983
AVERAGES FOR WEEK						
Sept.						
3	24.200	34.575	121.500	16.000	15.800	14.000
10	24.200	34.783	121.500	16.000	15.800	14.000
17	24.200	34.996	121.500	16.000	15.800	14.383
24	24.200	34.883	121.500	16.000	15.800	13.775
CALENDER WEEK AVERAGES						
Sept.						
6	24.200	34.458	121.500	16.000	15.800	14.000
13	24.200	34.929	121.500	16.000	15.800	14.133
20	24.200	34.854	121.500	16.000	15.800	14.250
27	24.200	35.029	121.500	16.000	15.800	13.621

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Sept. 1952	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	Holiday	Holiday	73.000d.	248s.	Holiday
2	278.0000	83.250	73.000d.	248s.	$35.00
3	278.0000	83.250	73.000d.	248s.	35.00
4	278.0625	83.250	73.000d.	248s.	35.00
5	278.0625	83.250	73.000d.	248s.	35.00
6	(e)	(e)	(e)	(e)	35.00
8	278.1250	83.250	73.000d.	248s.	35.00
9	278.1250	83.250	73.000d.	248s.	35.00
10	278.0625	83.250	73.000d.	248s.	35.00
11	278.1250	83.250	73.000d.	248s.	35.00
12	278.1250	83.250	73.000d.	248s.	35.00
13	(e)	(e)	(e)	(e)	35.00
15	278.1875	83.250	73.000d.	248s.	35.00
16	278.5000	83.250	73.000d.	248s.	35.00
17	278.5625	83.250	73.000d.	248s.	35.00
18	278.5000	83.250	73.000d.	248s.	35.00
19	278.5000	83.250	73.000d.	248s.	35.00
20	(e)	(e)	(e)	(e)	35.00
22	278.5000	83.250	73.000d.	248s.	35.00
23	278.5000	83.250	73.000d.	248s.	35.00
24	278.5000	83.250	73.000d.	248s.	35.00
25	278.5000	83.250	73.000d.	248s.	35.00
26	278.5000	83.250	73.000d.	248s.	35.00
27	(e)	(e)	(e)	(e)	35.00
29	278.5000	83.250	73.000d.	248s.	35.00
30	278.5625	83.250	73.000d.	248s.	35.00
AVERAGES FOR MONTH					
Sept.	278.310	83.250	73.000d.	—	35.00
AVERAGES FOR WEEK					
Sept.					
3	278.094	83.250			
10	278.088	83.250	—	—	—
17	278.300	83.250	—	—	—
24	278.500	83.250	—	—	—

Calender Week Averages, New York Silver: Sept. 6th, 83.250;13th, 83.250; 20th, 83.250; 27th, 83.250.

(e) No Market (Saturday)

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver is pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Lutjen

That we survived the Denver Mining Show at all, can only be attributed to several weeks of intensive training in New York subways and a fanatic insistence on three hours sleep per night whether we needed it or not. Rugged as the ordeal was, it was worth the effort. We came away with many interesting new acquaintances, some very good ideas, a somewhat distorted metabolism, and a complete set of matched bunions. Praise for all responsible for Operation Denver should be sprinkled liberally. We wish we had the space to list individual citations. On the few shortcomings, we would like to pass along some Constructive Criticism (or "Gripes," depending upon whether you are giving or receiving) we heard.

Housing accommodations were a sore point the first day, as the better Denver hotels filled up early and often, and the smaller hotels proved unsatisfactory to many. However, with some discreet bribing of room clerks and a general dispersal to outlying motels, the crisis evaporated.

Equipment exhibits were nothing short of spectacular. More than one man was heard to remark that the show should last more than four days to let the visitors make a thorough inspection of all the equipment. (Obviously, such remarks were made by the hardier element.) Certainly a rising vote of thanks should go to C. W. Stainback and his colleagues of the Manufacturers Division of the AMC.

Technical and economic sessions, off to a lively start with a panel discussion of the Paley Report, were generally of high caliber. *E&MJ* will bring you the highlights of these sessions in the November issue. Our personal vote for the Session-With-the-Most-New-Information was "Advances in Milling Practice." Occasionally, during the four days, a paper was given that would only win welcome from insomniacs. These papers insisted on presenting important data well submerged in trivia. During one of these, a Utah man on our right looked up from his crossword puzzle long enough to offer what we feel is a good suggestion to curb the long-winded, and keep technical sessions moving. "Why not," he asked, "have all papers printed or mimeographed and distributed to the listeners, and confine the speaker to 10 minutes for telling us why it's important to read the paper?" Why not?

Social functions during the show, formal and informal, were lavish and exhausting. We have nothing but admiration for the set of gay cavortees of the 4:00 am set who showed up bright and cheery behind stacks of waffles and pots of coffee at eight o'clock breakfasts every morning.

For the next Mining Show, we offer free of charge the slogan, "A sore foot on every ankle, and two bloodshot eyes in every head."

We are being hounded by Grammarians again. It seems that last month we ended a paragraph with the sentence, "You know what and whom it's for." "For," according to a couple of patient explanations we received this month, is a preposition. A preposition, it turns out, is a part of speech whose outstanding characteristic is that you are not supposed to end a sentence with it. In defense of our shattered professional integrity, we can only quote the reply of Winston Churchill, when he was accused of violating the same rule. "That is one rule of grammar, up with which I cannot put."

Golden Opportunity Dept. If you are a mining man who is apt to find himself stationed in the far reaches of the world where no man has ever been (with the possible exception of the man who erects the Burma Shave signs), you have a golden opportunity to contribute to Science's knowledge of Natural History. The American Museum of Natural History is always interested in obtaining specimens, animal, vegetable and mineral, from the outlying precincts. Prowling around the boondocks, mining men are a natural to pick up items that will make the museum's collections more complete. Who knows —you may even start them off on a brand new collection.

If you are about to go off on an expedition and feel you would like to make a contribution to Science, write to **Dr. Albert E. Parr; American Museum of Natural History; Central Park West; New York 24, N. Y.** Dr. Parr will send you a list of items the museum could use in its collection, that may be found in the corner of the world you are headed for, and presumably a briefing on the care and feeding of any flora or fauna you may bag.

Textiles impregnated with chlorophyll will probably be the next offering of chlorophyll-mad manufacturers to the equally chlorophyll-mad U. S. Public, according to a recent issue of *Chemical Week*. Apparently the idea is that such clothing will keep you smelling sweet and clean even if you haven't had a bath for weeks. This chlorophyll frenzy has to stop somewhere. How about someone making an anti-chlorophyll pill for people who want to smell?

For those who ask nothing more than a crisp October afternoon for a brisk workout on the slide-rule, we have a couple of real think-pieces. The first is on the use of Statistical Control in mill testing (p. 78). The enthusiasm with which mill men have approached this subject has been a little short of remarkable; in fact, it has been a little short. This is too bad. Nevertheless we'll bet a box of Corona-Coronas against an old Wilkie button that within a few years, mill men everywhere will be knee-deep in Quality Control. Meanwhile, *E&MJ* will keep you posted.

The other TP we mentioned, permits mining engineers to follow through with the installation of a full-automatic hoist. Just a word of caution: Don't let the wiring diagram on page 84 scare you. All roads including detours have been clearly marked. You should get a lot out of this and the milling piece.

ENGINEERING AND MINING JOURNAL

OCTOBER, 1952

Wanted: A Foreign Mineral Policy

NEITHER MAJOR POLITICAL PARTY can ignore the fact, once the election is out of the way, that many important recent activities of the U. S. Government in the foreign minerals field have been conspicuous and costly failures. This is a problem with which the winning candidate and his appointees must inevitably come to grips.

Let's be precise about it. We don't refer to the operations of the foreign region of the Bureau of Mines or the foreign division of the DMPA. We think these operations are in capable hands and their aims are being carried out as well as they could be.

We refer, rather, to the less clear-cut but far more devastating activities of such agencies as the State Department, the RFC, and a few assorted congressmen and their committees. These have gone about the world of late, scattering money foolishly at times, upsetting markets and showering abuse at others.

U. S. foreign mineral policies, or lack of them, have, at the least, annoyed governments abroad and at worst, have wrecked them. They have missed completely certain political objectives in Latin America, for example, that should never have been set up in the first place. They have gone far to destroy the faith and cooperation that should exist between U. S. industry and government, and they have antagonized and embittered most U. S. miners, who feel discriminated against. They have done nothing to help U. S. companies abroad in their struggle against the crushing burdens of unfair taxation and the rising tide of extreme nationalism.

Specifically: There have been allowed to grow several government groups competing with each other for power and money to use in stimulating mining abroad. There have been attempts to use metal markets to support a weak foreign government at the U. S. consumers' expense. Another government was allowed to collapse through misguided zeal in "saving the taxpayers' money." The strategic stockpile, supposedly inviolate, has been used as a club, or a prop, in attempts to influence world metal prices. All this has been done with little or no effort having been made beforehand to get, or to act upon, the advice of experienced mining industry members.

Lacking any coordinated purpose, and utterly remote from the realities of the market place, these enthusiasts in government go their separate ways. Some of them, as in the fiasco early this year in tin, even have the effrontery to brag of the job they did. This policy, if it can be called that, is bankrupt and must be discarded.

What can be done to replace it? We think the start has to be made in the State Department, itself. Preferably, industry men should be induced to take responsible posts in the department. That calls for new leadership, in which they can have confidence, right from the top on down. Unless this can be done, the present course of squandering money, unrealistic planning, and expensive failure can not be changed.

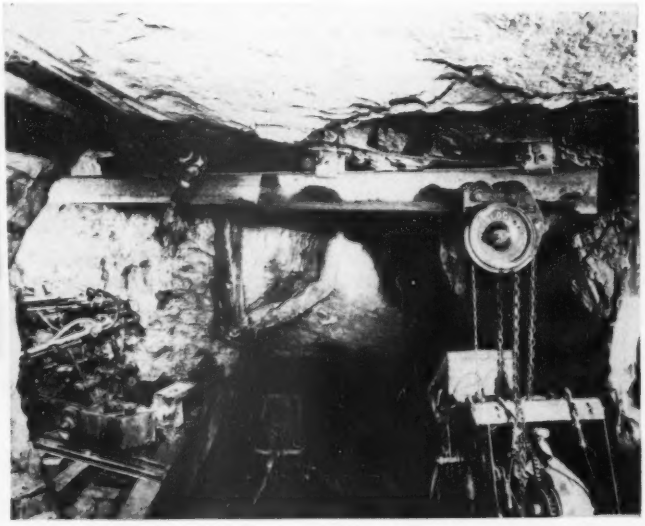
Having built a stronger department, one that can, and will, work with industry, all activities at the government level that will vitally affect the foreign mineral field should either be centered in the department or cleared with it. Only thus can such disasters as the RFC's "bull-in-the-tin-shop" tactics be avoided.

Lastly, the State Department must recognize that, although its activities lie abroad, its allegiance is to the people of the United States—all of them. We don't refer here to such obvious requirements as ridding itself of communist influence, but rather to the simple fact that the department ought to have an eye and an ear for the interests and complaints of those domestic producers and consumers who are inevitably affected by whatever the department does.

Is this too much to expect? Probably it is, at least immediately. However, only by recognizing the foregoing points as goals and working toward them, can U. S. foreign mineral policy avoid ending in anything but bitterness and frustration.

TWO MUCKING MACHINES are used in face at bottom of Ophir incline, each loading a 34-cu. ft. skip on respective track above it. This made it possible to get adequate advance. Machines have been modified for slope loading.

Dual Mucking Machines Speed Sinking of 26-deg. Incline



CHAIN LIFT AND MONORAIL are used to lift loaders from slope track to 1200 level station where they are kept when mucking is not in progress.

DON O. WILLIE
Superintendent
U. S. Smelting, Refining and Mining Co.
Ophir, Utah

SUCCESSFUL USE of dual mucking machines in sinking its 12x8-ft. 26-deg. incline shaft below the 1,400 level of its Ophir mine showed United States Smelting, Refining & Mining Co. that the key to adequate advance was an efficient mucking system.

Mechanical mucking makes shaft sinking a less strenuous task than it would be without it. Sinking an incline with mucking machines is not new; several companies have employed them with great success, mostly on grades of less than 26 deg. What had not previously been done was to use two loading machines in the face at the bottom so that both skips of the two-compartment incline shaft could be utilized.

CERTAIN CHANGES IN DESIGN were necessary to adapt loaders to slope loading. Bucket discharge angle is steeper and discharge lip is longer.

Efficiency Improves Gradually

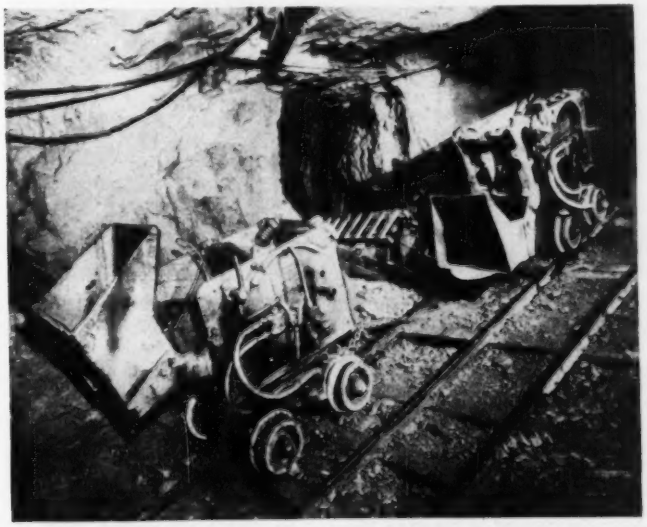
Originally, the Ophir was developed through incline shafts from surface. Then the 1,000-ft. level drain tunnel, 2,400 ft. long, was driven to permit more efficient removal of the mined ore. Plans for development, however, called for still better means of handling ore and waste. Access to the lower part of the mine was gained through two single-compartment inclines. Neither was adequate for even a short-range program, so the company decided to drive a two-compartment incline from the 1,000 level to the 1,600 level.

Below the 1,000 level, this incline was sunk as a single-compartment heading for 950 ft. Slabbing converted it into two compartments. A raise between the 1,200 and 1,400 levels and in line with the incline was utilized as part of the incline to the 1,400 level.

In sinking this incline a single mucking machine, converted for slope loading, was used successfully. Broken material was loaded into a car and hoisted to the collar by a 25-hp. single-drum hoist. An empty car was then lowered to the face. Hoisting was slow even though the distance was short. Much hand mucking was necessary. The best advance made was 65 ft. per month.

Two Loaders Installed

Because of the slow progress, adequate equipment was provided to extend the incline below the 1,400 level. An 80-hp. double-drum hoist was installed and pockets built at the head of the incline. This was followed by installation of double track, new 34-cu. ft. skips, two Rocker shovels, altered for slope loading, and facilities for rapid removal of equipment in the incline. Every effort was made to utilize equipment already on the property. Most units, however, were either old or too small. This was particularly true of the compressors, so two 600-cu. ft. units were installed. The additional air and higher pressure provided in this way were largely responsible for the excellent sinking progress made. Eventually much of the other equipment was changed or replaced.



DUAL LOADERS are at one side of incline at 1200 level, each chained to rail, awaiting resumption of mucking. This leaves two rails free for moving jumbo.

Slope Angle 26 Deg. Below 1400 Level

The dip in the original incline varied. From the 1,000 to the 1,200 level, a distance of 547 ft., it averaged 23 deg.; from the 1,200 to the 1,400 level, some 403 ft., it was between 26 and 30 deg. Below the 1,400 level it was set at 26 deg.

Total length of the incline is 1,527 ft. In cross-section it is 12 ft. wide and 8 ft. high above the track. Track gage is 30 in. and the two inside rails are spaced 24 in. apart to give the equivalent of three tracks, two of them 30-in. gage and one 24-in. The center track was used for moving a two-column, two-drill jumbo. Since completion of the incline, the center track has

served for transferring 24-in. gage equipment and supplies to the various levels. As the incline advanced, the track was held to course and grade so that, when the operation was complete a permanent track was established.

The ground through which the incline was advanced is hard and siliceous. No timbering was required and fortunately no water was encountered. Drill water was pumped from the face with a small air pump.

Incentive Doubles Advance

The operation was on a two-shift, six-day per week basis. Work was on an incentive basis after routine was established. The crew, exclusive of supervision, consisted of six shaft miners, two hoistmen, two motormen and two general underground men divided evenly on the two shifts, and one mechanic on the day shift. The shaftmen were capable of either drilling or operating the loaders.

Operating routine was one of drilling, blasting and mucking, each phase requiring a shift to complete. Such work as laying rails, installing pipes, moving anchor cables, changing loader drum cables and servicing the loaders increased the total cycle per round. The weekly advance averaged four to five rounds.

After sinking was put on an incentive basis, the advance was doubled to an average of 120 ft. per month. The best two-week performance was 68 ft. and the best advance for a single week, 35 ft. An average round broke 6½ to 7 ft. and gave 45 to 50 1½-ton skips of broken material—about 75 tons.

Changes in Design

To use two loading machines in the face of the incline, certain changes were necessary in the design of the loaders. The most important was to mount the cable drum on the inside rather than the outside of the rear wheels to provide sufficient room for both loaders.

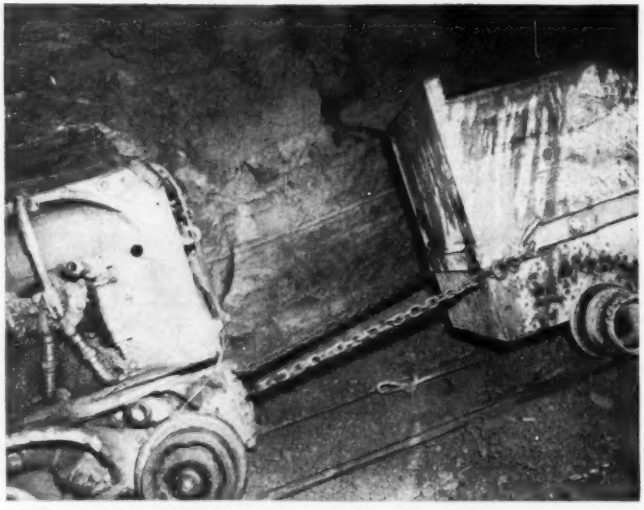
Other changes made in converting the loaders to shaft muckers were:

1. Making a steeper discharge angle on the bucket and adding 4 in. to the discharge lip.

2. Extending the rocker arms an inch from the frame to permit the bucket to swing freely to both sides on a wider-than-usual arc. There was no trouble keeping the sides cleaned down, though the rib was 2½-ft. from the track.

Another addition, made after operations were under way and the need became evident, was to attach a 200-lb. counterweight to the rear of the machine. Its chief function was to increase the machine's stability for digging in the muck pile. On an angle of 26 deg. the tendency is for the machine to nose over when digging in somewhat coarse muck and thus derail the loader. The counterweight did not solve this problem entirely, but it improved the condition materially.

DRILL JUMBO (left) is being lifted from center tracks of incline at station after round in bottom has been drilled. When round is blasted, loaders (right) will be put back on respective tracks and lowered to face.

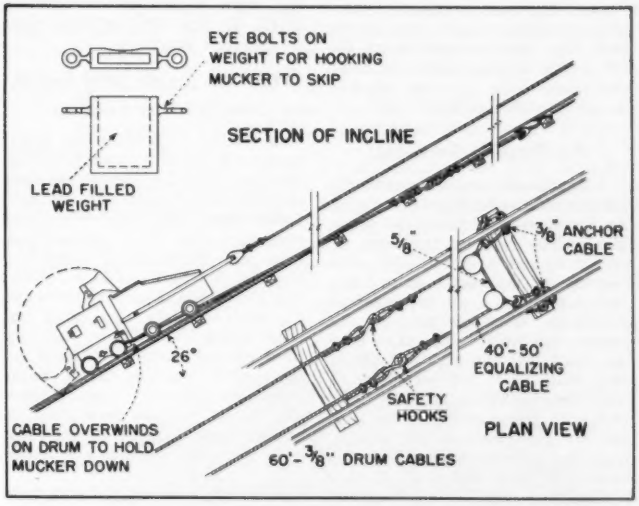


AFTER BLASTING, loaders are lowered from 1200 station to muckpile, attached by chains to respective skips. Chains are independent of each other.

Anchoring the Loaders

To anchor the loaders when in use, a double wrap of ⅜-in. cable was made around two adjacent

LOADED skip is ready for hoisting. Only one skip can be in bottom at a time. The other skip is in the dump at top. The loader for the latter skip is seen at the right of the heading.



CABLE ANCHORAGE for holding loader on incline track is shown schematically in vertical longitudinal section and in plan.

track ties so that the end loops fell inside the rails (two clamps kept the cable from slipping). Two snatch blocks for each loader were hooked in the end loops and a ⅝-in. equalizing cable was run through the blocks. Equalizing cables were 48 ft. long, although shorter lengths were available. The anchor cables were spaced at 40-ft. intervals. The 60-ft. drum cables of the loader were fastened to the equalizing cables by means of safety hooks. The accompanying drawing shows a schematic arrangement of the cable anchorage for mucking.

Sinking was completed without breaking an anchor cable or an equalizing cable. This was not the case with the drum cables. In this type of operation, breakage of drum cables is inevitable and must be anticipated. Broken strands warned of impending failure, and the cables were changed while the loaders were being serviced. If the drum cables broke while mucking, the loader would go forward until stopped by the muck pile. No accidents resulted from cable breakage.

Time Analysis for Typical Mucking Performance On Eight-hour Shift

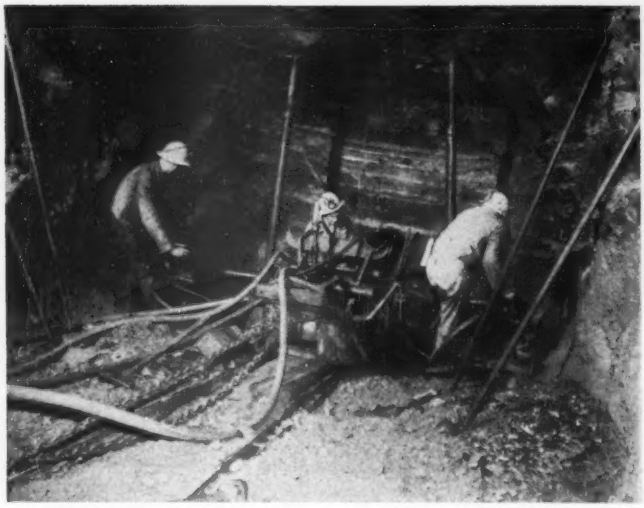
	Hrs.	Min.
Travel time to face		20
Lowering mucker and scraping down	1	30
Mucking	4	
Lunch time		30
Picking and trimming face	1	
Hoisting loaders		25
Transportation from mine		15
	6	120
Total	8	

The loaders were stationed at the 1,200 level. The east loader remained on the track just above the 1,200 level, and was anchored to the rail by a ½-in. chain. A monorail and chain lift were installed and used to place the west loader on the right of the incline and in front of the east loader where it was chained to the rail. This method of stationing the loaders freed the two center rails for movement of the drill jumbo between the 1,200 level and face (bottom) of the incline. If servicing was required, the machines were picked up and placed on a track on the 1,200 level. The jumbo was always stored on the 1,200 level and serviced during the loading cycle.

After blasting, the loaders were lowered to the anchor cables in the incline by means of two ½-in. chains hooked at one end to rings in the counterweight on back of the loader and at the other end to rings on the side of the skip. The chains were independent of each other. As a rule considerable muck was scattered up the incline which required scraping down by hand to uncover the anchor cables. After the loaders were anchored, the muck was pushed mechanically until suitable for loading.

The Time Analysis

Loading speed was determined largely by the fragmentation. In moderately fine muck, a skip could be loaded in as little as 1½ min. During a mucking cycle, an average of 10 to 12 skips was loaded each hour. The best performance



DRILL JUMBO is in position for drilling at face in bottom of incline, after removal of two loaders to 1200 level station.

recorded for continuous loading was 21 skips in 65 minutes.

Obviously this was accomplished with ideal rock containing no large boulders. Time required to load a skip, hoist it and return it to the face was six minutes. All hoisting was done out of balance to facilitate the work and return the skips to bottom as quickly as possible.

Time used in breaking boulders, laying ties, and waiting for skips reduced the number of skips which could be loaded during a shift. Cleaning and trimming the face required an hour of the mucking cycle, and part of the last skipful was hand-mucked. After the face was cleaned, the loaders were chained to the skips, hoisted, and stationed at the 1,200 level. The accompanying table gives a time analysis of a typical mucking performance for an eight-hour shift. This schedule was maintained except when it was necessary to install track or pipe or move anchor cables.

Too much emphasis cannot be placed on the importance of having a trained, efficient operator. Most of the success of the loading depends on his skill. From three to four weeks of training were necessary before smooth and effective performance could be expected. Ability to coordinate the various movements of the machine was attained only by constant practice. Until the operator had had sufficient experience to know how much tension to maintain in the cables, there was always the probability that his next move would result in derailing the loader. This was particularly true when mucking coarse rock. Rather than dig into the bottom of the muck pile, it was quicker to scoop the muck from the top, thereby uncovering the boulders.

Air Pressure Important

Adequate air pressure contributes greatly to the efficiency of mucking. An increase from 80 to 100 psi at the loaders reduced the time required to load by about 50%. The response of the machines to a few pounds increase in air pressure was noticeable. With low pressure the loaders did little better than drop the muck into the back end of the skip. With 95 to 105 psi the muck could be thrown well to the front end, with resultant full skips. During the early part of the sinking operation air pressures did not exceed 80 lb. and only 26 skips were loaded per shift. After the new compressor plant was installed, the number of skips loaded was doubled.

Poorer Work on Steeper Grades

During the sinking the loaders were used for a short time on grades as steep as 30 deg. Performance was not satisfactory. The adoption of loaders on slopes steeper than 26 deg. is possible if other changes are made in the loaders. For a few rounds, because of an error in the grade stick, the incline was advanced on a 25-deg. slope and improvement in mucking efficiency was noticeable.

Cost of repairing the loading equipment was moderate, aside from the initial alteration. Drum cables, rocker arm cables, bucket chains, and link pins failed frequently. During the sinking 1,000 ft. of $\frac{3}{8}$-in. cable was used. Rocker arm cables were used at the rate of four per month. Chain life was two months for each loader.

A Fine Report for the Two Loaders

In general, the performance of the loaders on an inclination of 26 deg. was excellent and operating efficiency increased materially. Rate of advance and footage per man-shift increased; sinking costs were cut and fewer men were needed. The work was less laborious.

The machine proved sturdy under difficult conditions and required little attention beyond maintenance and lubrication. Safety with Rocker shovels compares with safety with the same equipment in driving drifts. During sinking there were no lost-time accidents.

How the Round Was Broken for the Dual Loaders

THE DRILLING CYCLE in the Ophir incline offers little change from regular practice. Two $3\frac{1}{2}$-in. drifters mounted on a two-column, two-drill jumbo were used for drilling. The rods, used with $1\frac{5}{8}$-in. carbide bits, were made from $1\frac{1}{4}$-in. round, hollow steel in lengths of 46 in., 76 in., and 106 in. Single-use steel bits and $1\frac{3}{4}$-in. insert bits were tried, but were found unsuited to the very hard ground. Average footage for the carbide bits was 427 ft. These bits were generally ground three times. Only new bits were placed on starter steel, and reground bits were gaged for seconds and finishers.

About 90% of bit failures were due to broken inserts; 8% were discarded because of broken skirts; and only 2% were lost in holes or damaged beyond use when rod threads failed. No bits were discarded because of excessive wear, although a number had more than half the insert worn away when breakage occurred. None were lost because of bit-thread failure.

Unit bit cost per foot of hole drilled was $3\frac{1}{4}$¢, including labor cost for regrinding. Use of tungsten-carbide bits made it possible to drill out in a shift. Four sets of

steel, all equipped with bits, were kept at the face during the drilling period.

The average round broke to a depth of 6½ ft., although many rounds exceeded 7 ft. Each round in the incline consisted of 54 holes breaking to a middle V-cut. Other types of rounds were tried but none proved as satisfactory as the V-cut. A burn cut was effective in breaking the round, but required more holes and took longer to drill. The disadvantage of the V-cut was that it scattered the muck for a considerable distance up the incline. The V-cut was formed by three parallel holes on each side drilled 4 in. apart, thus making a wedge 8 in. thick. These holes were blasted with O-delay primers and more or less burned out the center of the face. The pattern of the rest of the round was four rows of holes on each side and six rows deep. Relievers were drilled on each side of the cut.

The round was loaded and blasted as soon as it was drilled. Powder used was 45% semi-gelatine, and consumption amounted to 38 lb. per ft. Use of less powder invariably resulted in leaving bootlegs. A 5-hp. fan was employed to exhaust the gases resulting from blasting. Large rock fragmentation also resulted when too little powder was used. This directly affected the efficiency of the loaders.

Some Additional Facts About the Ophir Operation

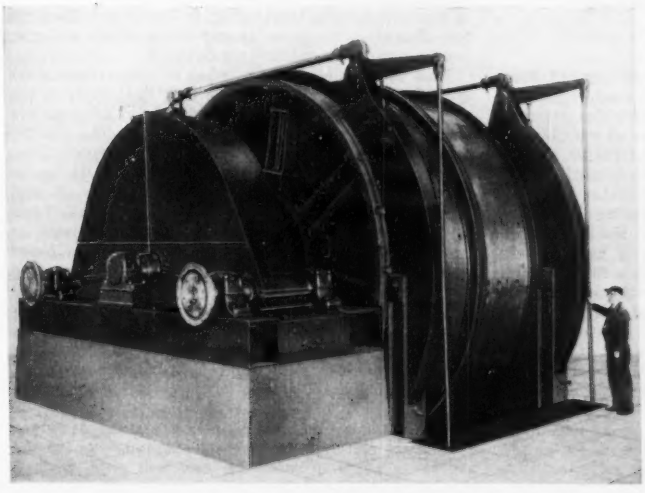
THE OPHIR UNIT of United States Smelting, Refining & Mining Co. is situated in the Ophir mining district, in Utah, on the west slope of the Oquirrh Range. It lies within one of the nation's greatest mining regions. To the south are the Mercur and Camp Floy districts, and to the north and east the Bingham area. The Bauer and Rush Valley mines are north and west.

Ore was discovered at the Ophir in 1870. During the next 10 years, the mine was a substantial producer. After 1900, when the Clark interests of Butte acquired control, operations increased and for the next 26 years, the mine was a steady producer. In 1926 it was abandoned, considered exhausted. Since then sporadic resurges on a limited scale have occurred under small leasing operations, principally on showings left by early operators. No new discoveries were made. The mine has produced close to 1,250,000 tons of ore valued at $20-million. Compared with other mines of the period, it was regarded as one of the most profitable.

Geologically, the deposits occur near the crest of the northern limb of the Ophir anticline, which plunges north and south from Ophir Canyon. The anticline is cut by the east-west canyon fault zone. Total vertical displacement of the beds exceeds 2,000 ft. One result of the faulting is the exposure on the northwesterly side of the canyon of the entire stratigraphic column of sedimentary rocks from the Lower Cambrian Tintic quartzite to the Upper Mississippian Great Blue limestone. Another fault zone of considerable economic importance is the northerly trending Clift Fault, presumably a branch of the Canyon Fault. Total throw is 250 ft.

The productive horizons of the mine are confined to the Ophir formation consisting of several thin beds of limestone separated by relatively thin beds of shale. The formation is overlain and underlain by thicker shale members. Total thickness of the formation is 300 ft., consisting of four principal producing limestone beddings locally known as the Blue, the Green, the Red, and the Yellow. The Blue and Green limestones contain the most persistent mineralization, and are 8 ft. and 6 ft. thick respectively. They are separated by a shale member varying in thickness from 2 to 6 ft. In many instances the beds have been mined as one. About 40 ft. above the Green limestone is the Red limestone 8 to 10 ft. thick. The Yellow limestone 40 ft. above the Red limestone is the thickest bed, averaging about 25 ft. Although some excellent orebodies were found in the last-named limestones, production has been far below that obtained in the Blue and Green.

The orebodies occur as blanket-like replacement deposits of the favorable limestone beds along a series of north trending fissures. The fissures are tight, steep dipping structures which seldom exceed 4 in. in width, and in the shales become no more than mineralized cracks. They control the extent of ore deposition, and orebodies are not found where the fissures do not exist. There are five independent fissure systems, each being responsible for a major orebody.



Third 2500 Hp. Hoist on Way to Yugoslavia

AN 18-FT. DIAMETER double cylindrical drum hoist, the third of six ordered, is on its way to a lead-zinc-silver mine in Yugoslavia. The electric hoist, made by Vulcan Iron Works, Wilkes-Barre, Pa., is single reduction geared to be driven by two 1250-hp. motors. The 51-in. face of the drum will carry two layers of 1¾-in. rope.

Ultimate depth of the mine will be about 2400 ft., the 10th level. Hoisting from three levels, the 5th, 7th, and 9th, capacity of the hoist will be 2,000 metric tons of ore per shift. Bottom-dump skips, also supplied by Vulcan, carry 6 metric tons per trip. Rope speed is better than 2400 fpm.

University of Alabama's Adrian Dorenfeld presents an easy lesson in Factorial Design . . .

A New Way To Get Better Results, Save Money

EDITOR'S NOTE:

Here is your chance to get in on the ground floor of a relatively new tool, FACTORIAL DESIGN. Other industries are using it with outstanding results. This is what it can mean to millmen:

1. Saving in time and money by cutting down the number of tests required.

2. Better results because you measure not only the effect of variables, but the effect of interaction between variables.

3. Results are valid over the range of variability in your ore. (On most testing today, results are only valid for ideal conditions adopted.)

4. You can predetermine the error; thus if a change of reagents is contemplated, of substantially equal cost, and involves no costly mill changes, then if the average results are only 50% of the time better than previously, it might pay to change. The level of significance is 50%. If, however, a flotation plant is to be converted to a cyanide plant, with the attendant heavy capital costs, the level of significance could be put at 1% or even 0.1%—in order to be absolutely certain within the determined limits, that cyanidation is unquestionably better. Nothing is left to judgment, except the setting of the level of significance.

Author Dorenfeld demonstrates why most present test procedures are at fault and offers a blueprint which you can follow in applying the Factorial Design to your own testing. The example here involves only three variables for the sake of simplicity, but the method can be extended to cover any number of variables.

Much of the theory of Factorial Design is omitted here for quicker, easier reading. However, upon written request, *E&MJ* will be happy to supply you with a concise bibliography of Quality Control.

Early work on the application of Factorial Design to mineral engineering was done at Columbia University and is now being carried on at the University of Alabama.

ADRIAN C. DORENFELD
Asst. Prof. of Mineral Engineering
University of Alabama

THE ULTIMATE PURPOSE of conclusions derived from tests, is to apply them to mill scale production. But what mineral plant has even certain variables constant, let alone all variables? How then, can all variables be kept constant, save the one under investigation, if none are really constant? Yet, the accepted testing procedures in the mineral industry predicates test conclusions on keeping all variables constant. Further, which variables are important ones at the start of an investigation? If this were known, why have the expensive investigations? Is it not possible for variables to interact and the *interaction* cause the result? The fact is, that the accepted test procedures yield conclusions that are merely subjective guesses, guided to some extent by experience, the testing of the particular ore, and a "sixth" sense. These conclusions, then, are probably not much better than educated "guesstimates."

Consider a typical ore test. Great pains are taken to get a large sample, sometimes a ton or so, picked from the entire orebody, so that as near a "representative" ore sample as possible is obtained. The laboratory, to do a good job, now proceeds, very carefully, to mix the sample thoroughly, to be certain that one test charge is the same as any other. Tests are run, results compared, conclusions deduced.

Now then, in all logic, to what do these conclusions apply? The answer can only be that they apply to the mixed ore sample—and that is all! After all, ores are variable—in quantity of valuable mineral, quality, grain, size, salts, etc. This variable is neglected. Further, in the author's ten years of mill experience in large western plants, he has not heard anyone ask for, or give, the experimental error of any test result. Tests are compared as if each test, or average of tests, is exactly reproducible; and how can conclusions based on these tests with unknown error limits be applied to the entire orebody, since the conclusion was based on mixed ores—but its application is on a variable ore? The fact is, that the "conclusions" based on most tests, are guesses; they may, or may not be valid conclusions for a variable ore. Only full-scale production will tell that. And full-scale production is certainly expensive testing.

Even when a great many tests are made, standard procedures merely average the tests, and compare the averages. Any two series of tests will yield, by and

DEFINITION OF TERMS

NORMAL DISTRIBUTION is a mathematical distribution made up of individuals perfectly described by knowing the average and standard deviation of these individuals; see Fig. 1.

MEAN OR AVERAGE is the line which divides a distribution area in exactly equal parts; see Fig. 1.

VARIANCE is a measure of variation of the data about the mean.

STANDARD DEVIATION is the square root of the variance.[3] It is given by the formula:

$$\text{Standard deviation} = S = \frac{\sqrt{\Sigma X^2}}{n} - X$$

POPULATION OR UNIVERSE is the infinite number of tests that could be made using one particular physical condition. The greater the number of tests, the closer the approach is to the population.

SAMPLE is a finite number of tests, N, drawn at random from a population. Each sample will have its standard deviation, S, and average X.

SIGNIFICANCE LEVEL is the risk taken in being wrong. Thus a significance level of 5% means that in the long run the conclusion may be wrong five times out of 100 times. It is usually fixed by the economics of the situation. If large-scale costly additions would be necessary to install a new process, then a significance level of 1% or better would be justified; if the new process is merely a change in reagents, of substantially equally costs, then a significance level of perhaps 20% might be justified.

F DISTRIBUTION is the distribution of variances. Tables for this distribution exist. See Table 4.

in Mill Testing

large, two different averages. Identical results are accidental. Which one is better? Probably neither is. At present, it is left to the opinion of the investigator as to whether one set of tests is significantly different from another.

What Factorial Design Is

If a series of tests is run, the results will yield, approximately, curves such as in Fig. 1. This is a normal distribution, or error curve. Now, if one of the variables is varied, but the results fall within this established area, then the variation had no influence on the results. It was within the experimental error. This method will yield valid conclusions based on the experimental error of the system under consideration. It is in constant use in the physical sciences and psychological clinics. However, to make such comparison requires a great number of tests, and for plant scale tests with a large number of variables to be investigated, would be extremely expensive.

Methods exist which arrive at these conclusions in a rigorous, logical mathematical manner, yet use a fraction of the number of tests required by standard statistical methods. One of these methods is called Factorial Design.

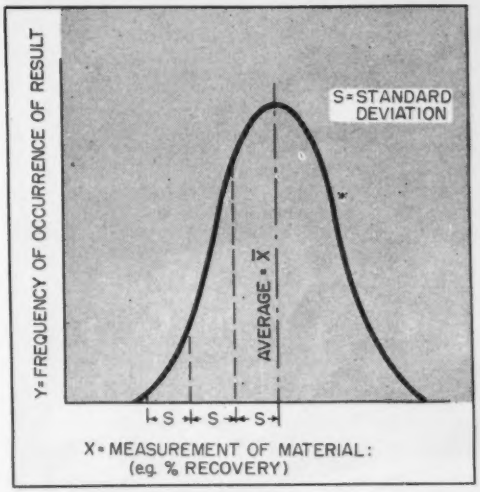


FIGURE 1. Results of almost every test series will fit this curve of normal distribution.

How Factorial Design Works

To see how Factorial Design works, let's study a case in which we consider only three factors and each on two levels. Our variables will be xanthate (X), pH (P), and fineness of grind. With three factors back on two levels, we have eight possible variations in our tests:

$X_1P_1G_1$	$X_1P_1G_2$
$X_1P_2G_1$	$X_1P_2G_2$
$X_2P_1G_1$	$X_2P_1G_2$
$X_2P_2G_1$	$X_2P_2G_2$

To demonstrate the use of factorial design we crushed a porphyry copper ore to —10 mesh and made up 1000 g. test charges. The ore was not mixed; constant factors were frother at 0.10 lb./ton to flotation cell; 5 minutes flotation; 1000 ml. tap water to ball mill. Variables were set at the following values:

X_1 = 0.2 lb. xanthate/ton
X_2 = 0.3 lb. xanthate/ton
P_1 = pH 8.5
P_2 = pH 10.5
G_1 = 65-mesh grind
G_2 = 200-mesh grind

From tests of the eight possible combinations of variables, we get the results noted on Table 1 on page 80.

Keeping one of the variables at a constant value, we can make four different tests. Take P_1 for example. In tests, $X_1P_1G_1$, $X_1P_1G_2$, $X_2P_1G_1$, $X_2P_1G_2$, P_1 is a common factor and differences in results of these tests must be due to X and G. Any given test can be used three times; in studying results due to X, and G, or X and P, or P and G.

"HOW CAN TESTS on controlled samples logically be applied to run-of-mine ore that is inherently variable!"

Table 1—Result of Tests

Test No.	[illegible], Grind	pH P	Xanthate X	Recovery %Cu
1	$X_1P_1G_1$.... 65-mesh	8.5	0.2	62.87
2	$X_1P_2G_1$.... 65-mesh	10.5	0.2	74.84
3	$X_2P_1G_1$.... 65-mesh	8.5	0.3	60.61
4	$X_2P_2G_1$.... 65-mesh	10.5	0.3	72.07
5	$X_1P_1G_2$....200-mesh	8.5	0.3	70.66
6	$X_1P_2G_2$....200-mesh	10.5	0.2	82.61
7	$X_2P_1G_2$....200-mesh	8.5	0.3	63.29
8	$X_2P_2G_2$....200-mesh	10.5	0.3	86.12

With P_1=pH 8.5 and P_2=pH 10.5, we first must see whether results of this change show significant variations, or whether results due to pH are within the experimental error. To test whether results with P_1 differ from results with P_2, let us assume first that P_1 is but an experimental variant of P_2, or $P_1 = P_2$. This doesn't say that a pH of 8.5 is the same as a pH of 10.5. It means that results due to pH changes are no different than could be attributed to ordinary experimental errors.

With this assumption test ($X_1P_1G_1$) is but an experimental variable of ($X_1P_2G_1$) and we can add the results together. (Similarly other tests may be added.) From the original eight tests, we now have four runs, having eliminated P: X_1G_1, X_1G_2; X_2G_1, X_2G_2.

Assuming $P_1=P_2$, so that $X_1P_1G_1=X_1P_2G_1$, and concerning ourselves with recovery, we can add (from Table 1) 62.87 and 74.84. We also add 60.61 and 72.07 ($K_2P_1G_1$ and $X_2P_2G_2$), etc. This gives us Table 2:

Table 2

	X_1	X_2	Total
G_1.....	137.71	132.68	270.39
G_2.....	153.27	149.41	302.68
Total.....	290.98	282.09	573.07

To estimate the effect of G, we now assume that G_1 results are an experimental variant of G_2; therefore, X_1G_1 and X_1G_2 can be added and we have two sums, X_1 and X_2:

$$X_1G_1 + X_1G_2 = 137.71 + 153.27 = 290.98$$
$$X_2G_1 + X_2G_2 = 132.68 + 149.41 = 282.09$$

If we now add the squares of each of these seems, X_1 and X_2, and then divide by the number of observations making up each sum, we have a measure of the sums of squares of this effect:

$$\frac{(290.98)^2 + (282.09)^2}{4} = 41{,}061.03$$

However, we are interested in learning whether a variance deviation of an effect like X is or is not different from the variance due to the experimental error.

To determine this experimental error, we first establish the total variance of all the tests, since variances are addative. Then knowing the variance of each effect, and each interaction, we need only subtract all of these from the total variance to find the variance of unknown causes—the error. By definition the variance S_2 is:

$$S^2 = \frac{\Sigma X^2}{n} - \left(\frac{(\Sigma X)}{n}\right)^2 \quad (1)$$

Where X equals each operation, and n equals number of operations.

Multiplying through by n,

$$nS^2 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} \quad (2)$$

For ease of calculation, equation (2) is used. The term $(\Sigma X)^2/n$ is called the Correction Factor, or C.F.; the term ΣX^2 is the sum of the squares.

From Table 2;

$$\text{C.F.} = \frac{(573.07)^2}{8} = 41{,}051.15$$

Since the C.F. is part of all variances it must be subtracted from the sums of squares of an effect, to measure the variance of results due to that effect:

$$\text{X effect} = \frac{X_1^2+X_2^2}{4} - \text{C.F. (Table 2).}$$
$$= 41{,}061.03 - 41{,}051.15 = 9.88$$
(Table 2)

$$\text{G effect} = \frac{(270.39)^2+(302.68)^2}{4} - \text{C.F.} = 130.33$$

Suppose that G will not influence results unless X is a certain value. In short, G reacts with X to produce its own effect. (To illustrate: cyanide does not react at low pH, but is active at high pH. This is a first order

interaction. In tests involving four or more factors, second and third order interactions are possible). To obtain the XG effect the squares of all GX runs are added and from the sum are subtracted the G effect, the X effect and C.F.:

From Table 2 (C.F. = 41,051.15)

$$XG \text{ effect} = (X_1G_1)^2 + (X_2G_1)^2 + (X_1G_2)^2 + (X_2G_2)^2 - X \text{ effect} - G \text{ effect} - C.F.$$
$$= (137.71)^2 + (132.68)^2 + (153.27)^2 + (149.21)^2 - 9.88 - 130.33 - C.F. = 0.17$$

By repeating these processes, we obtain effects of the different sources of variance.

Next, we square the results of each individual test, add and then subtract the C.F. This total is the sum of all deviations.

Difference between this sum and all accounted-for deviations like P,G,X, and interactions is the *residual*. The residual may be due to errors in sampling, assaying, test procedure variation, etc.:

Table 3

Source of Variance	Variance
P (pH)	423.55
G (grind)	130.33
X (Xanthate)	9.88
GP	16.11
PX	13.44
GX	0.17
Total accounted for effects	593.48

Total Variance = 609.70

Residual or experimental error = 609.70 − 593.48 = 16.22

If the first order interactions GP, GX, PX are to exist, i.e., if they are not merely within the experimental error of the test series, then their standard deviations must be greater than the residual or experimental error. In this case (Table 3) the interactions are numerically less than the residual and therefore within the experimental error. The evidence is that within the experimental procedure used, the interaction had no effect on results.

Since they are within the experimental error, the interactions are part of the experimental error. We can now add them together to obtain an estimate of a new residual. This residual can come from any of four known ways, the three interactions and the old residual (Statistically, the new residual is said to have four degrees of freedom). We, therefore, divide by four to obtain an average residual:

From Table 3

GP = 16.11
PX = 13.44
GX = 0.17
Old residual = 16.22

New residual = 45.94 ÷ 4 = 11.49

The X effect, 9.88, is numerically less than the new estimate of the residual. This means results due to variation X and within the experimental error. In other words, results using C, are experimental variants of results using X_2. Therefore tests that merely differ in X can now be averaged.

The G effect is 130.33. We divide this deviation by the residual 11.49 and obtain a ratio F, of 11.35. The numerator has 1 deg. of freedom, the denominator has 4 deg. of freedom. Looking this up in the F distribution table (Table 4) at the 5% level, we find the number 7.71. Our ratio was 11.35. This means that we are certain the grinding will have a definite effect on the results 95 times out of 100.

Table 4—Distribution of F*

Degrees of Freedom

Denominator	Numerator 1	2	3	4	5	6	7
1	161	200	216	225	230	234	237
2	18.51	19.00	19.16	19.25	19.30	19.33	19.36
3	10.13	9.55	9.28	9.12	9.01	8.94	8.88
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88

*Portion of Table only

The F distribution table indicates for the degree of freedom involved what F (or ratio the variance due to effect and the residual) should be at a level of significance of 5%. Other F distribution tables give the same information for a level of significance of 1%. In effect you determine how right you want to be. If tests involve a change of reagents, you can afford a level of significance of 50%. Your tests only have to be right half the time, because the money involved is small and you can afford to literally say "it doesn't make much difference, one way or the other." If you are thinking of making a process change that would mean a $100,000 plant reconstruction, the level of significance would be 1% or better. You'll want to be sure your results were valid 99 times in a 100.

In the case at hand, we now know that G, or 65-mesh grinding affects the results as compared with G_2 or 200-mesh grinding. Similarly the P effect is shown to be significant.

As our residual variance is 11.49, the variance of any *one* test is 11.49. Since variance is the square of the standard deviation, the standard deviation of any one test is $\sqrt{11.49}$ or 3.38.

The standard deviation of the average of a test is $3.38 \div \sqrt{n}$. In this case where two tests are averaged we have $3.38 \div \sqrt{2}$ or 2.39.

We can now say that within the experimental error of the tests, xanthate has no influence on recovery, but pH and grinding do. We can obtain estimates of average recoveries and their standard deviations and put them in tubular form (Table 5). We do this by taking the mean of tests 1 and 3 ($X_1P_1G_1$ and $X_2P_1G_1$ on Table 1) where grind (G) was 65 mesh for both tests, and pH (P) was 8.5 Xanthate (X) was varied, but we have shown that this variation is not significant. We repeat this calculation for the three other groups of

Table 5

Conclusion	Physical Conditions pH	Grind	Xanthate lb/ton	Recovery %Cu. Mean 1 Standard Dev.
1	8.5	65-mesh	0.2 to 0.3	61.74 ± 2.39
2	8.5	200-mesh	0.2 to 0.3	66.98 ± 2.39
3	10.5	65-mesh	0.2 to 0.3	73.46 ± 2.39
4	10.5	200-mesh	0.2 to 0.3	84.36 ± 2.39

"VARIABILITY is the only constancy in the application of statistical principles to mineral engineering."

tests when only X varies, to complete Table 4. These are our conclusions based on Factorial Design.

Let's go back a moment to Table 1 to see what our conclusions would be based on the current standard procedure, varying one variable at a time and not getting an estimate of experimental error.

(1) Effect of xanthate: Test $P_2G_2X_1$ gave 82.61% recovery. Test $P_2G_2X_2$ gave 86.12% recovery. Conclusion: At a pH of 10.5 and 200 mesh grind, 0.3 lb./ton xanthate, gave 5.51% better copper recovery than 0.2 lb./ton xanthate.

(2) Effect of Grinding: Test $P_2X_2G_1$ gave 72.07% recovery. Test $P_2X_2G_2$ gave 86.12% recovery. Conclusion: Grinding to 200 mesh at a pH of 10.5 and 0.3 lb./ton xanthate, increased recovery 24.05%.

(3) Effect of pH: $P_1X_2G_2$ gave 63.29% recovery. Test $P_2X_2G_2$ 86.12% recovery. Conclusion: At a 200-mesh grind, and 0.3 lb./ton xanthate, increasing the pH from 8.5 to 10.5, increased recovery 22.83%.

Let's compare conclusions:

Table 6—Comparison of Conclusions

Variable	Effect on Cu. Recovery Standard Method	Factorial Method
pH (Concl. 2 & 4, Table 4)	22.83%	17.38%
Grind (Conc. 3 & 4)	24.05%	11.10%
Xanthate	5.51%	Within Exp. error

First, the most striking difference between the conclusions arrived at by the usual manner and those of the Factorial Design, is the fact that the results due to xanthate variation were shown to be within the experimental error of the tests. It is immaterial whether 0.2 or 0.3 lb./ton xanthate is used, within the limits of these tests, since the recoveries will fall substantially within the recovery limits determined by the pH and the grind. Second, the effect of either pH or grinding variations is not as great as one could be led to believe by comparisons of single tests. It is perfectly possible to imagine a case where grinding an ore from 65-mesh to 200-mesh would be more costly than the value of the material recovered. Therefore, getting as near the facts as possible—what to expect on the average—will go a long way in avoiding wrong decisions.

Which set of conclusions is correct? Evidence that the factorial set of conclusions is correct is presented. Two tests were run, using the conditions of pH 10.5, 0.3 lb./ton xanthate, 200-mesh grind (Test $P_2X_2G_2$), with the following % Cu recoveries resulting: (1) 84.65 (2) 78.01. This is an average of 81.33 % ± 3.32. For any group of two tests, this average would be $81.33 \pm 3.32 \div \sqrt{2}$ or 81.33 ±2.35%.

Using the standard statistical method of the comparison of means, the means 84.36 (conclusion 4, Table 5), ± 2.39 and 81.33 ± 2.35 can be shown to be samples of the same population—there is no significant difference between the two means.

Therefore, conclusion No. 4, Table 5, is shown to be sound, since other repeat tests, using one of the physical conditions upon which the above conclusion was based, have been shown to yield similar results.

An additional use of the factorial method of analysis, is that evidence can be obtained to show that no valid conclusions, can be drawn from a series of tests—that the experimental error is too large and the series of no value. Such evidence means that the experimental procedure, in some way, is defective.

At first glance, it may seem odd to try to find out something by not keeping all variables constant, save the one under investigation. *Actually, as shown previously, constancy of variables is an illusion.* If one wishes to demonstrate simple physical laws, such as the falling of different substances in a vacuum, the variation of variables one at a time provides the investigator a means to get at a cause and effect relationship.

In contrast to this, the testing of a complex system such as flotation of an ore, or grinding or classification, or filtration, etc., with a host of variables, mostly unknown, the investigator is almost completely ignorant of the physical inter-relations, and can only ascertain a final result, within limits, such as grade of concentrate, recovery, new surface created, etc. Which are the important variables? In testing none should be presumed—you may be badly misled. Using the factorial method, the advantages shown have been:

1. Greater efficiency: the main effects were evaluated with known precision, using only a fraction of the tests otherwise required;

2. Completeness: in addition to all the main effects, *interactions were shown not to exist*, in this case. These interactions may be of great importance. However, of even greater importance is the fact that the conclusions are valid over a *range* of ore variability, as well as a range of variability of the other variables. If the test were standardized, the conclusions are only valid for such standard conditions. Hence the factorial conclusions have a wider inductive basis and a wider range of application.

The application of statistical principles to mineral engineering is straightforward. It does require, however, a concept that *the only constancy is variability.*

Full-Automatic Hoist Controls Increase Tonnage Raised by 20%

A. B. CHAFETZ, Member AIEE, International Minerals & Chemical Corp., Carlsbad, N. M.
R. D. CALL, Member AIEE, Westinghouse Electric Corp., Application Engineer, St. Louis, Mo.
H. A. LONDON, Westinghouse Electric Corp., Application Engineer, El Paso, Texas

INTERNATIONAL MINERALS & Chemical Corp., one of the nation's largest producers of potash and potash chemicals, has had to increase its hoisting capacity three times in the past ten years to handle growing mine production at Carlsbad, N. M. Important design features of the latest unit, a high-speed automatic hoist, are described in this article.

Chief Design Problems

1. Smooth skip loading required. The chief problem was the design of control circuits which would regulate operation of the skip loader. The skip loader is a batch-load type with an eccentric hopper, overturned by weight of the skip engaging a bail. This bail must be approached slowly. The rate at which the skip leaves the bail must also be slow to avoid bounce of the hopper. Dumping of skips in the headframe is not a serious problem because the Kimberly overturning type used here unloads rapidly.

2. Power peaks not permitted. Shortly after World War II, production increases demanded more power, and a new contract was negotiated with a utility company which required that the wound-rotor hoist motor be eliminated as part of the load because it imposes frequent highs on the system. Hence, allowances were made for an estimated increased tonnage of 20% per hour.

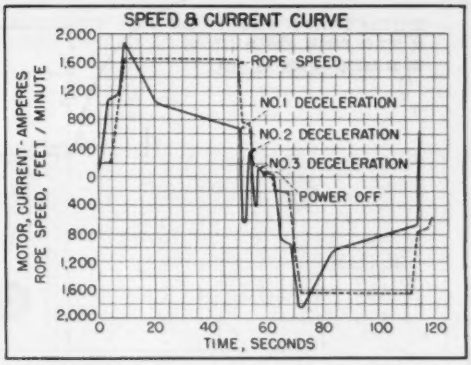
3. Faster hoisting cycle. Changes brought about by the study resulted in the following hoisting cycle:

Loading time	12 sec.
Acceleration	10 sec.
Deceleration	10 sec.
Full speed time	32 sec.
Total time	64 sec.

Other data considered were:

Skip load	5 tons
Rope speed	1,650 fpm
Distance traveled	1,050 ft.

4. Flywheel absorbs power peaks. Recommended equipment to meet the above performance requirements included a main 800-hp. dc motor, 600 v., 450 rpm; a motor-generator flywheel to absorb peaks; and a 600-hp., 2,300-v. wound-rotor and slip regulator to furnish power for the main drive motor. The motor-generator set equalizes power required for the ac line. This equalization is accomplished by using stored energy in the flywheel, and allowing the M-G set to operate over a wide range of slip. The slip is from 765 minimum to 865 maximum with current being controlled by the slip regulator and torque motor. The current can be set accurately by selecting the proper taps on the series transformer feeding power to the torque motor, proportional to the input to the wound-rotor motor.



ACCURATE ADJUSTMENT of automatic rotating control shaves down hoisting cycle time to 62.5 seconds.

5. Simplified control system. Because of the wide speed range through which the generator operates, an accurate control must be maintained over the excited field for proper operation of the main drive motor. The usual method of controlling this field is the Ward-Leonard system. However, for this installation the Rototrol method was selected to secure the refinements of regulation afforded by the Rototrol and to minimize the number of magnetic contractors and relays necessary in the controller.

When the installation was first made, it was semi-automatic. Acceleration and final stop were under control of the operator. Deceleration was automatic down to a very slow rate of speed under the control of a travel-nut limit switch with three points, whose position was proportional to the skip position.

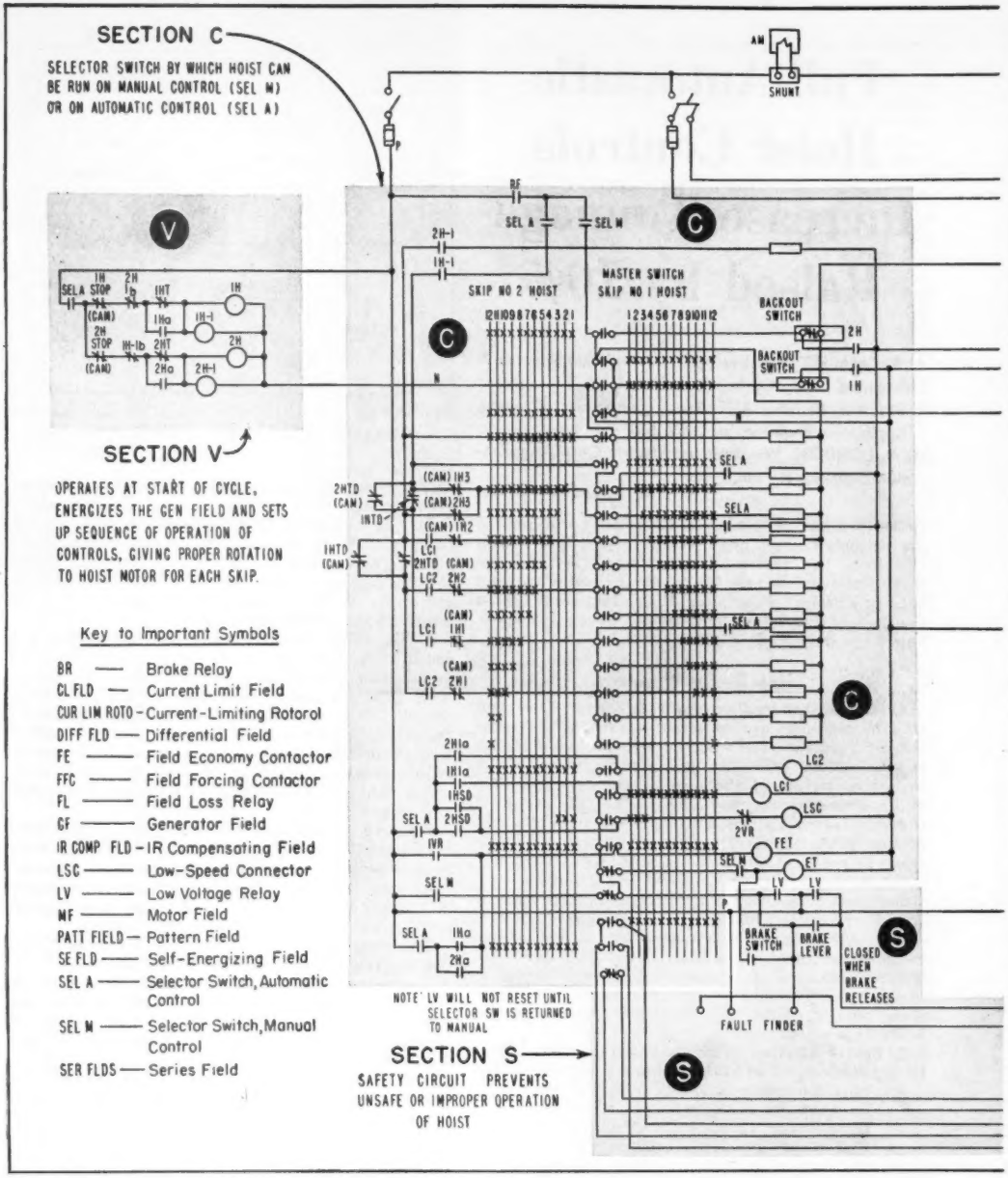
This operation was satisfactory for awhile until the demand for more tonnage was imposed.

A study was made and cycle times checked on the various operators. A wide variation in time was found among the operators, and this difference was traced to three operations—the time spent in loading, time entering, and time leaving the loader. The variation was from 66 seconds to 75 seconds, but in no instance was the designed 64 seconds reached. It was determined that only 5 seconds were required to properly load the skip and it was assumed the balance of the time lost was consumed in the skip entering and leaving the loader, since the full speed of 1,655 fpm was being reached. A load check and temperature run was also made to determine exact loading on the equipment.

The time study and current load tests showed that by going to full automatic operation, a consistent cycle could be reached which would meet the design cycle and by force ventilating the motor the load could be increased 15%.

By studying the control, it was found that a change from semi to full automatic could be made with the addition of a selector switch; replacing the travel

(Please turn to page 84)


SECTION C
SELECTOR SWITCH BY WHICH HOIST CAN BE RUN ON MANUAL CONTROL (SEL M) OR ON AUTOMATIC CONTROL (SEL A)
SECTION V
OPERATES AT START OF CYCLE, ENERGIZES THE GEN FIELD AND SETS UP SEQUENCE OF OPERATION OF CONTROLS, GIVING PROPER ROTATION TO HOIST MOTOR FOR EACH SKIP.
Key to Important Symbols
BR — Brake Relay
CL FLD — Current Limit Field
CUR LIM ROTO - Current-Limiting Rotorol
DIFF FLD — Differential Field
FE — Field Economy Contactor
FFC — Field Forcing Contactor
FL — Field Loss Relay
GF — Generator Field
IR COMP FLD - IR Compensating Field
LSC — Low-Speed Connector
LV — Low Voltage Relay
MF — Motor Field
PATT FIELD — Pattern Field
SE FLD — Self-Energizing Field
SEL A — Selector Switch, Automatic Control
SEL M — Selector Switch, Manual Control
SER FLDS — Series Field
SKIP NO 2 HOIST
MASTER SWITCH SKIP NO 1 HOIST
BACKOUT SWITCH
SHUNT
NOTE LV WILL NOT RESET UNTIL SELECTOR SW IS RETURNED TO MANUAL
SECTION S
SAFETY CIRCUIT PREVENTS UNSAFE OR IMPROPER OPERATION OF HOIST
BRAKE SWITCH
BRAKE LEVER
CLOSED WHEN BRAKE RELEASES
FAULT FINDER

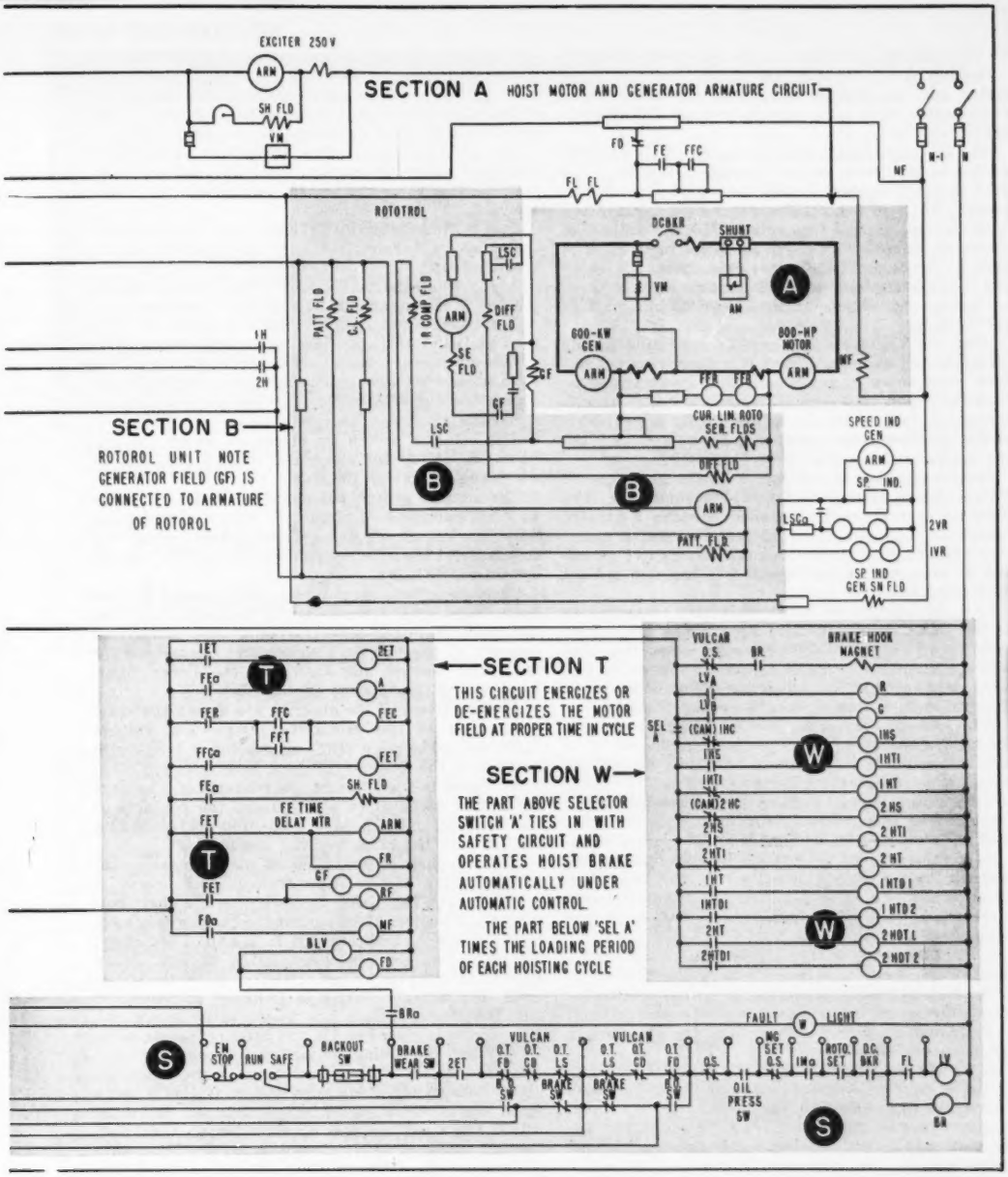
How the Automatic Hoist Control Operates

The hoist is driven by an 800-hp. dc motor powered by a 600-kw. generator as shown in Section A. Speed of the hoist motor, direction of rotation, and maximum and minimum torques developed by the motor during acceleration or deceleration are regulated through the generator field (GF). This generator field is connected to the armature of the Rototrol (see Section B) which in effect is a simple dc generator. This Rototrol generator has five separate fields (shown in Section B) which limit and regulate the amount of current generated by the Rototrol.

Section S is a conventional safety circuit. Section W ties in with the safety circuit, setting the hoist brake under certain conditions. It also regulates the energizing of the motor field (MF). Section V sets up a sequence of desired operations at the start of automatic hoisting cycles.

(*Continued from page 83*)

nut with a switch having higher accuracy and more points; and timing relays for loading time. It was decided to add separate acceleration resistors, since the equipment would operate manually at times.



A three-position selector switch was used with an "automatic, manual-and-off" position. The travel nut limit switch was replaced with a cam switch having 10 double-throw switches. This switch is geared to the drum through a 65 to 1 speed reducer since the cam only rotates through 270 deg. while the skip travels 1080 ft. The position is always proportional to the location of the skip. Flux-decay type timing relays were selected from their reliability standpoint. Three relays operating in sequence are required for each side for the loading period.

By proper adjustments of the deceleration points it was possible to decelerate the skip uniformly to the proper speed for entry into the loader. Acceleration was more of a problem since the rate of acceleration was too great to start under full conditions before the loader was cleared. To control the acceleration, a point on the cam switch is used in conjunction with a relay supervised by timing relays.

A brief description of this system of control may

be clarified by reference to the schematc diagram.

Section A of the diagram shows the 800-hp. dc motor and the 600-kw. generator armature circuit connections, with a dc circuit breaker for overcurrent protection.

The dc motor shunt field windings (MF) are connected to the 250-v. exciter through a resistor, with field economy contactor (FE) and field-forcing contactor (FFC) to control the motor field current and with the coil of field loss relay (FL) the contact of which is connected to cause the hoist to be stopped and the brake set if the motor field current falls below a predetermined value. Operating coils of these contactors are shown at the lower middle part of the diagram.

With the dc motor field windings excited in one direction and at normal strength when the hoist has been brought up to any speed, the direction of rotation, the speed of the hoist motor and the maximum torques developed by the motor during acceleration or deceleration are controlled and regulated through the medium of the generator field (GF).

Section B shows the Rototrol, to the armature of which the generator field (GF) is connected. The Rototrol is a specially designed rotating regulator having high amplification of field current to armature current. It is similar in construction to a standard dc generator excepting that it has five special field windings:

1. A self-energizing field (SE FLD) connected in series with the Rototrol armature. When the circuit resistance is adjusted to the proper value, this field will maintain the Rototrol armature voltage at any point on its air gap line when the effects of the other Rototrol field windings neutralize one another.

2. A pattern field (PATT FLD) which causes the Rototrol armature voltage to be established at a value determined by the point on which the master switch is set. When the hoist motor reaches the speed corresponding to any position of the master switch the effect of this field is neutralized by differential field and the IR compensating fields described below.

3. A current limit field (C.L.FLD), excited by the current limit Rototrol described in the following, which limits to a predetermined value the maximum current in the hoist generator-motor armature circuit.

4. A differential field (DIFF FLD) connected across the generator terminals to produce an effect in the Rototrol fields proportional to the hoist motor speed, the speed being almost directly proportional to the hoist generator voltage less the IR drop in the armature circuit.

5. An IR compensating field (IR COMP FLD) connected when the low speed contactor (LSC) is closed, excited in proportion to the current in the hoist generator-motor armature circuit, to assist the differential field in maintaining nearly flat-speed torque characteristics for accurate, low-speed landing of the skips.

The current limit Rototrol (CUR LIM ROTO) is a special dc machine having between its main field poles magnetic shunts which are designed to saturate at a predetermined value of field excitation. It has three field windings:

1. A series field winding (SER FLDS) connected across the commutating pole field windings of the hoist generator and motor, producing an effect proportional to the current in the hoist motor armature circuit, tending to saturate the magnetic shunts. By adjustment of the resistor in series with this field, the shunt is caused to saturate at a predetermined value of current in the hoist motor armature circuit and any increase in current above this value will cause the current limit Rototrol to generate voltage which is impressed upon the current limit field (CL FLD) of the Rototrol. The consequent variation of the hoist generator voltage limits its armature current to the value for which adjustment has been made.

2. A pattern field (PATT FLD) producing a cumulative effect varying with the point to which the master switch is moved. This is opposed by:

3. A differential field (DIFF FLD) excited in proportion to the voltage of the generator armature.

The pattern and the differential fields on the current limit Rototrol function to obtain the same magnitude of current limit under transient conditions such as acceleration, deceleration or plugging, as in steady state operation.

Section C of the diagram shows:

The selector switch by means of which the circuits are set up for automatic control (SEL A) or for manual control (SEL M).

The master switch connected to resistors in the Rototrol pattern field circuit, by means of which the hoist is reversed, accelerated and 12-point speed control obtained when the selector switch is set for manual operation (SEL M).

Contacts of the cam limit switch geared to the hoist, when open successively to decelerate and stop the hoist in either direction of travel. Additional contacts of the cam limit switch and relays used for automatic control are shown at the lower right-hand part of the diagram (Section W).

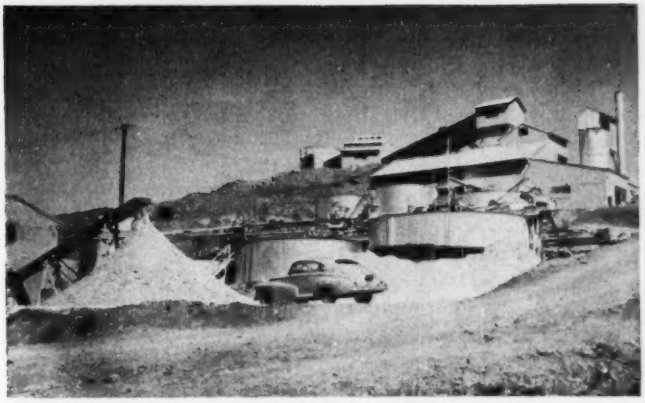
At the bottom of the diagram are shown the operating coils of the protective relays—low voltage (LV) and brake relay (BR)—connected in series with contacts of the conventional hoist safety devices.

As shown in the diagram, the contacts of all relays are in the deenergized position and the contacts of the cam limit switch in the position corresponding to that with the skips midway in the shaft.

The sequence of operation of the automatic controller during one hoisting cycle is as follows:

Assume the No. 1 skip is resting on the shaft bottom in the loader. At this point the cam switches are in the following position: 2H-1, -2, and -3 are open; 2H stop open, 2HC is closed, 1H-1, -2, and -3 are closed, 1H stop is closed, 1HTD is closed, 1HC is open. The selector switch is switched to automatic and the timing relays are momentarily energized. The circuit is closed to 1H and 1H-1 contactor up to 1HT. When the timing contactors time out, the hoist starts to move. Full acceleration is prevented by 2HTD cam switch being open and relay 1HTD being open. The accelerating contactors time out, and close 1HTD relay putting full acceleration on the hoist, through switches 1H-1, -2, and -3. As the No. 1 skip approaches the dump position, the deceleration cam switches are approached in sequence 1H-1, 1H-2, 1H-3 and uniform decelerating takes place. As 1H-3 is engaged, the hoist speed is down to 125 fpm and has contacted the loader bail. The balance of the travel is completed at this speed until the cam switch 1H stop is engaged at which time the power is removed from the hoist. Simultaneous with the opening of 1H stop, 2HC closes and starts timing for the hoist cycle of No. 2 skip.

By accurate adjustments, it was possible to obtain a cycle time of 62.5 seconds and thus increase the tonnage 20% over the projected tonnage per hour.



A FLOWSHEET for treating the barite rare-earth ore is being worked out here, using certain sections of the mill as a large-scale pilot plant.

A Visit to the Mountain Pass Rare-Earth Enterprise

Exploration of deposit continues and a flowsheet is being worked out.

EVER SINCE LAST JANUARY when *E&MJ* published a preliminary report on Moly Corp.'s rare-earth bonanza in southern California, interest in this unique development has continued high. The question asked most frequently is "What's going on there now?" To get the answer we recently visited the mine and mill at Mountain Pass, in San Bernardino County. The prospectors, Clarence Watkins and Herbert Woodward, who discovered the large barite-carbonate lode, have made real progress.

Further exploration has shown that the deposit covers about 20 acres and extends to depth. Values average 10% in rare earths, though the scattered, small, high-grade concentrations may be as high as 40%. Barite content throughout the lode averages 20%, but runs more than 50% in local masses.

Besides the bastnasite, the principal rare-earth mineral, monazite and an unidentified rare-earth carbonate are locally abundant; likewise calcite, dolomite, and silica. Allanite is present in minor proportions. Diamond drilling is being done in areas in which radioactive monazite occurs. Sampling has been done by wagon drilling to depths of 50 ft., with dust samples taken every 5 ft. in a MultiClone collector. In general, the holes were drilled on a 100-ft. grid. In the high-grade area holes were spaced at 50 and 25-ft. intervals.

Mining and milling were started on a modest scale in mid-February. The ore is treated in the former Sulphide Queen mill, where several units were adapted to beneficiating the barite and rare earths. Currently, operations may be considered large-scale pilot-plant work for a larger mill, to be erected in the future.

The ore is mined in open pit. Overburden is negligible. Blast holes are drilled with I-R wagon drills and broken ore is loaded into 4-ton trucks by a Bucyrus-Erie ¾-yd. diesel shovel. Haulage distance from the pit to the 150-ton mill bin is about ¾ mi. An International tractor fitted with a dozer blade and an Actco loader unit are also in service.

The 100-ton mill is handling 70 tons a day, producing barite and rare-earth concentrates. The flowsheet differs little from that of the conventional flotation plant handling nonferrous ores. Ore is crushed in two stages, going first to a 15 x 24-in. jaw crusher, then over a 3 x 6-ft. vibrating screen, and finally to a 2-ft. Symons cone. Screen undersize and cone product are collected in two 100-ton fine-ore bins. Grinding to 80% minus-200-mesh is done in a 4½ x 8-ft. ball mill in closed circuit with a Dorr classifier.

In the flotation work, close control of pH and pulp density are important. A pH of 9 and pulp density of 20% solids are maintained. Classifier overflow is conditioned and sent to the barite rougher machine, made up of four Denver cells, and the concentrates are cleaned in two Denver cleaner cells. Cleaner tailings are returned to the head of the rougher.

Rougher tailings are conditioned and sent to a four-cell Agitair rougher machine which produces the rare-earth concentrates. These are cleaned in two stages. Available for this are two primary cleaner cells and a secondary cleaner.

The tailings from the rare-earth rougher machine pass through a two-cell unit before going to a 30-ft. dewatering thickener. Concentrates produced are cleaned in one cell, with tailings returning to the head of the two-cell unit. The final concentrates produced by the cleaner cell are low-grade.

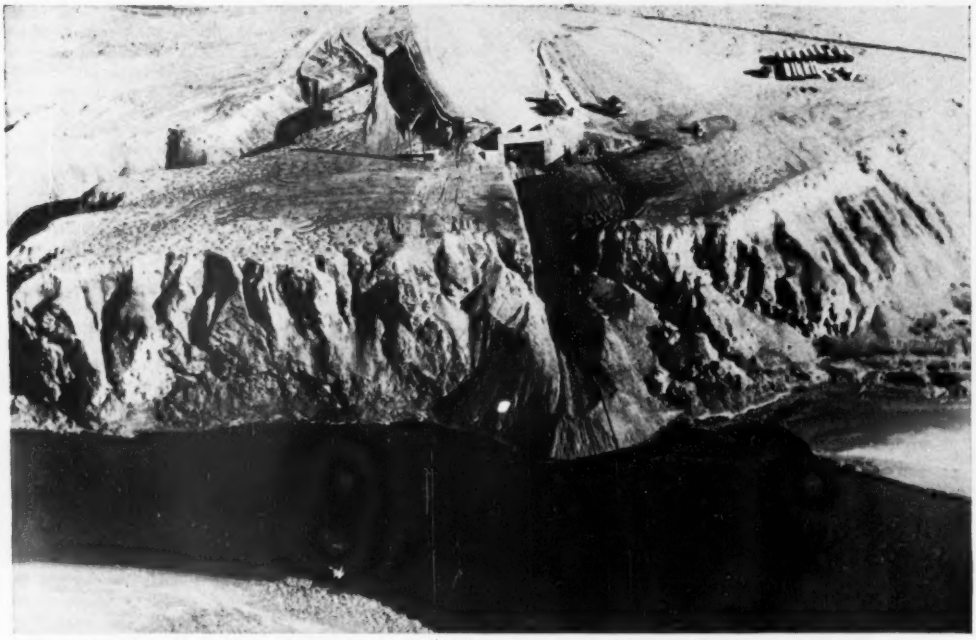
Reagents used in the barite circuit are Aerosol and tannic acid or quebracho. In the rare-earth soap flotation they are principally Armour Neo-Fat. Soda ash or caustic soda are added for pH control. All concentrates produced are thickened and filtered.

Acid Leach Planned

In an acid leaching plant now under construction, rare-earth concentrates will be digested in acid-proof tanks with diluted hydrochloric acid heated with steam to 165 deg. F. The digested material will be filtered through silica block filters, the solution diluted and oxalic acid added for precipitation of rare-earth oxalate. This product will be filtered and dried, and then passed through a small kiln for conversion to rare-earth oxide.

The surface plant also includes a general office, laboratory, warehouse, and combination power-compressor house containing a compressor and three 180-hp. Murphy diesel generators which furnish power for mill and camp.

Operating officials at Mountain Pass include H. D. Bailey, manager, Russell Wood, engineer and assistant manager, A. M. Wilson, mill superintendent, John Martin, mine superintendent, and Chris Lee, assistant mill superintendent.



TWO-BUCKET REVERSIBLE TRAMWAY, 1600 ft. long, brings the bentonite from the mine across the Big Horn River to treatment plant that has been erected on this side. The width of the river often exceeds a quarter mile.

Air Tramway Solves Transport

CHARLES F. DWYER
Staff Engineer
Heron Engineering Co.
Denver, Colo.

WHAT WOULD YOU DO about transportation if you found a workable ore deposit on one side of a river and the only suitable plant site on the other side? That's the problem that faced the Magnet Cove Barium Corp. They knew that extensive bentonite deposits were available in the area east of Greybull, Wyo., and that large-scale surface operations could be developed.

Because of lack of utilities, railroad siding and roads, however, the plant had to be erected north of Greybull. Between the deposits and the plant site ran the Big Horn River.

1600-Ft. Tramway Designed

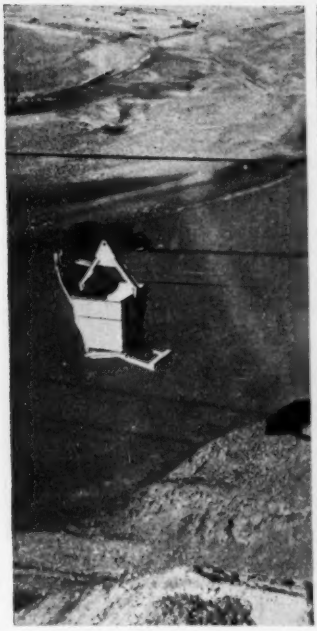
Building a bridge was economically prohibitive because United States Army restrictions demanded high, clear spans over the river at this point. The use of existing bridges added a 6-mi. haul to the plant site, partially over near-impassable roads.

This interesting problem was solved by the erection of an aerial tramway. The tramway offered various advantages, particularly in respect to cost and time. Photos and data used here have been supplied by Colorado School of Mines' *Mines Magazine*.

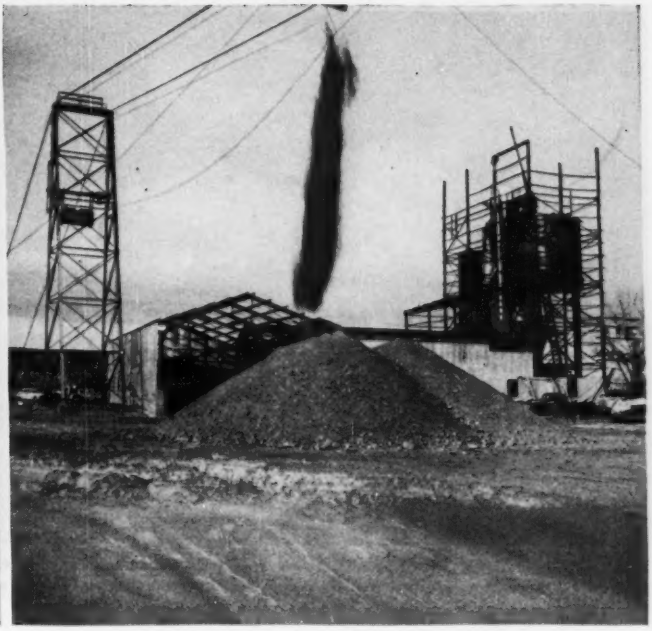
To provide the tramway engineering service, handle material procurement, and furnish construction supervision the Heron Engineering Co., of Denver, was called in. A tramway approximately 1600 ft. long and having a capacity of 60 tons per hour was needed. Various types of tramways were considered, but the nature of the terrain, the distance to be traversed, the capacity desired, and other factors led to the selection of the time-proven two-bucket jigback, or reversible, tramway. This type uses large wire ropes which form a suspended track over which two carriers travel back and forth from loading terminal to discharge point. A single continuous haul, or traction, rope operating through the reversible drive machinery moves the carriers. With the elimination of intermediate supports, this system permits the handling of material at an extremely high rate of speed and consequent high capacity.

Flattened Strand Rope Used

Two-inch diameter Leschen "Hercules" flattened-strand wire rope was selected as track cable. The flattened strand was used for this purpose because it provided a large proportion of metal wire to the total cross-sectional area, the strands are fitted together in a manner which offers maximum resistance to crushing, and a relatively smooth outside wearing surface is available. A $\frac{5}{8}$-in. mild plow-steel wire rope was chosen for the traction cable; since this rope was to pass over sheaves and through the drive machinery, flexibility was necessary in addition to strength and resistance to wear.



BUCKET is hauled by traction rope over suspended wire rope track.



BENTONITE WAS STOCKPILED at plant site while mill construction was under way. The automatic bottom-dump buckets provide trouble-free operation.

Problem at Magnet Cove

Precautions in Designing Bins

The loading terminal for the tramway included the design of two 25-ton hoppers into which the trucks dumped. Structural steel hopper bottoms mounted the segmental big gates. All gates were to be controlled from the operating platform with air valves and large air cylinders. Every precaution was taken in the design of bins and gates to meet problems arising from the fact that bentonite, when wet, becomes very sticky. Bin and hopper walls were kept as nearly vertical as possible. The hoppers incorporated in the terminal served as a gravity feed for the tramway and provided a large storage capacity to regulate the flow of material delivered by the trucks.

Trippers Are Moveable

At the discharge point moveable trippers were designed to mount on the track cables, providing automatic dumping for the carriers. The moveable feature would permit dumping at any point along the line and provide over 100,000 tons stockpile capacity. The large stockpile at the plant site was to permit continuous operation even in winter when surface mining and hauling might be impossible.

Tramway Construction Spectacular

With the completion of all concrete work the erection was begun under the supervision of Charles F. Dwyer, of the Heron company. The steel tower was erected in record time with the aid of a large crane and experienced crews. The steel loading hoppers were positioned in the terminal and field-welded to insure sturdy, dust-tight bins.

In the drive terminal it was relatively simple to mount machinery. All machinery was held in place by anchor bolts cast in the concrete supports. Terminal sheaves directing the traction cable into the drive sheave were mounted on structural steel members fitted between the walls of the terminal structure.

Placing of the large track cables was the most spectacular part of the erection and attracted much attention. The 2-in. track cable came in a single length with sockets on either end. Over 1700 ft long, the cable on each reel weighed well over 6 tons. Two large tractors were employed to string it along the line, and to accomplish the precarious crossing of the river. A lead line of ½-in. wire rope was first pulled across by lighter lines and this in turn pulled the large track rope across. The crane used in erecting the tower was employed to lift the track cable into position in the tower saddles. The ⅝-in. traction rope was pulled into place in much the same manner as described for the 2-in. cables. With tension in the track cables provided through the hoist and anchorage reeving, the carriers were placed on the line and attached to the traction cables by wire-rope clips. After proper alignment of drive machinery and sheaves, the tramway was ready for the transfer of bentonite from the ore deposit to the plant.

KINGS MOUNTAIN CONCENTRATOR recovers spodumene from pegmatite ore, as well as other economic minerals in gangue. These include cassiterite, columbite, monazite, feldspar and mica. For methods, see below.

Demand for Lithium Boosts Mining

EXPANSION OF FOOTE MINERAL CO.'S spodumene mining operations at Kings Mountain, N. C., will increase production from 300 to 1,000 tons daily by early next year. The heavy demand for lithium has more than caught up with the original processing facilities. By stepping up the output it will be possible to meet the requirements of the company's new $3,500,000 lithium extraction plant which is to go into operation next summer at Sunbright, Va.

To accomplish this expansion, the company will install larger mining and crushing equipment and other facilities. The new 28-in. primary gyratory crusher will be followed by secondary cones, replacing present equipment. Two new 5 x 12-ft. rod mills, capable of handling 800 to 1,000 tons a day grinding to 20 mesh, will be provided.

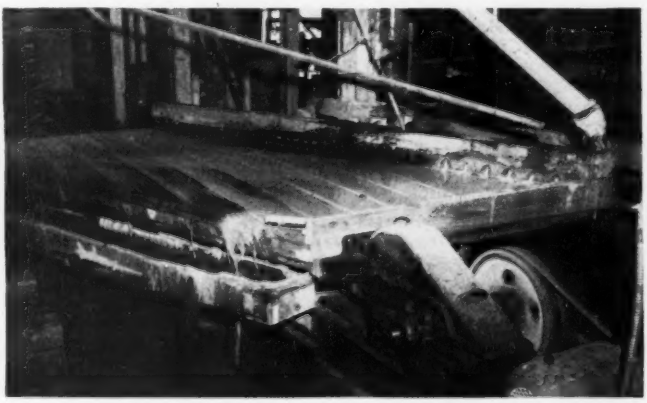
Largest Known Deposit

The pegmatite deposit in which the spodumene is found at Kings Mountain contains about 20% of the lithium aluminum silicate (spodumene), also 35% feldspar, 2-3% mica, and 40-45% silica. This occurrence of spodumene is the largest known in the Western Hemisphere.

The Foote company owns or controls the mineral rights on 850 acres at Kings Mountain. Centering at this point, the spodumene extends from Lincolnton, N. C. to Gaffney, S. C. The area has been extensively mapped and prospected. Core drilling to determine the extent of its reserves is planned by the company.

Mining at Kings Mountain is done in open pits by drilling and blasting the irregular discontinuous dikes which carry the spodumene. These average 50 to 100-ft. in width and, as indicated by core drilling, extend to a depth of about 900 ft.

The overburden, mostly decom-



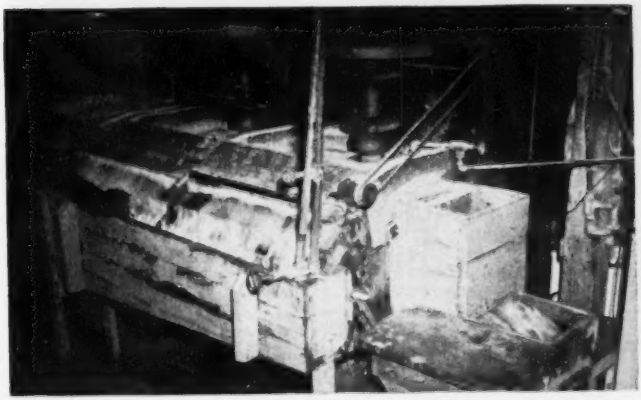
HEAVY MINERALS in Kings Mountain pegmatite are removed on Humphreys spirals. Rougher spiral concentrates are upgraded on this table to carry 45% cassiterite, 33% columbite, 14% pyrrohotite, and 8% monazite.

AFTER DRILLING AND BLASTING the face of the dikes, the pegmatite ore is loaded by power shovel into trucks for transportation to crushing plant.

at Kings Mountain

posed rock which varies in depth from nothing up to 40 ft., is removed by power shovels.

The plant and processing facilities at Kings Mountain were purchased by Foote Mineral from the Solvay Corp, late in 1951. The primary task is to recover the spodumene which is shipped direct to the company plant at Exton, Pa. Later it will go to the new plant at Sunbright, Va., when the latter is completed. The finished product will go direct to glass companies, after magnetic cleaning has removed the hornblende. This is not separated by flotation and amounts to about 2 to 3% of the spodumene.



FLOTATION is employed to recover spodumene from spiral tails. This is the economic product primarily sought. It is cleaned magnetically to remove hornblende before shipment. Feldspar, mica, and quartz are floated off.

From the quarry, the pegmatite is hauled to the crushing plant where it is reduced to gravel size and screened. Oversize is recrushed.

Material under ¾-in. size is stockpiled. From this storage it is reclaimed and ground to 20 mesh. Oversize is returned to the grinding mill. This uses liner blocks of granite, 12 x 6 x 4-in. in size, instead of the imported Belgian flint pebbles.

Process Developed by Research

The process for recovering the spodumene was worked out by the Minerals Research Laboratory of North Carolina State College at Asheville under the direction of Dr. Jasper L. Stuckey. Research led to pilot plant operations before the Kings Mountain plant was designed and constructed. The company has retained as a consulting engineer Ralph Adair, who was in charge of the research laboratory at Asheville when the process was under development.

The material, 20 mesh and under, goes to the wet plant for separation of heavy minerals, by gravity. The plant uses eight 24-A five-turn Humphreys spirals in the separation. The tails, containing the spodumene, feldspar, mica and quartz, go to flotation for further separation.

Treated by flotation, the feldspar, mica and quartz are removed as froth and floated away from the spodumene. The spodumene is then pumped to large drainage basins for drying before shipment.

The tailings of feldspar, mica and quartz are stockpiled. Some mica is recovered by take-off at the outer rim of the spirals. Plans of the company now include equipment to separate the feldspar and mica by flotation.

The spodumene concentrate is 80% spodumene and 6% LiO_2.

Further Work Planned

Research and development conducted by the company have led to plans for rearranging the present process and installing additional equipment which will permit recovery of the by-products of the lithium-spodumene material.

Mining is under the direction of Dudley Rainey, mining engineer, graduate of the Colorado School of Mines. Edwin Goter, graduate of North Dakota School of Mines, is assistant plant manager and in charge of milling. W. R. Hudspeth is plant metallurgist. Alfred B. Chandler is manager of the plant.

PRODUCTION SHAFT of Kennecott Copper's Deep Ruth project, in Nevada, will be sunk to 1,572 ft. Two 12-ton skips will be handled by a 3,000-hp. Nordberg hoist. When in full operation, it will hoist 8,000 tons of ore per day.

New Copper Projects in Nevada Will Open

JOHN B. HUTTL
Associate Editor

THE VITALITY of some of the older mining areas in the West is illustrated by the stepped-up activities in the Ruth-Kimberly copper district in Nevada. Here, Kennecott Copper Corp.'s Nevada Mines Division is developing two new sources of low-grade porphyry ore to increase its metal output, and has explored a third project by diamond drilling and churn drilling to the point where mining can begin whenever it is desired. The three undertakings are known as the Deep Ruth, the Kimbley pit, and the proposed Veteran pit. When they are ready, there will be available for mining and milling more than 46-million tons of ore assaying slightly less than 1% copper. With production from current sources, the annual copper output is expected to reach about 50,000 tons.

The Deep Ruth project, when completed, will be an underground

KELLINSKE VENTILATION SHAFT for Deep Ruth project is being sunk at angle of 55 deg. to depth of 2,245 ft. Recently it had reached the 885-ft. point measured on the slope. It is served by a single-drum hoist.

KIMBLEY PIT will produce about 4,500 tons of ore per day. Up to early July, 10-million tons of waste had been removed as shown above.

More Ore for Kennecott

operation. Current activities are centered in preparing a large porphyry orebody containing 25-million tons of ore for block-caving. The plans include sinking a five-compartment vertical production shaft, a two-compartment, 55-deg. inclined ventilation shaft, known as the Kellinske, about 1 mi. away, and establishing three haulage levels running ½% grade from the production shaft to the ore zone.

The work is being done under contract by Foley Bros., Inc. Part of the orebody lies under the southern part of the town of Ruth. All dwellings here must be moved.

The site of the production shaft is near Ruth to the north. A new mine plant is nearing completion there. It consists of a large combination hoist-compressor house of concrete and steel, a 155-ft. steel headframe with built-in loading chutes; also repair shops, electrical substation, and a railroad switch yard.

Hoisting equipment includes a 3,000-hp. Nordberg double-drum hoist with a dual drive for handling the 12-ton skips, to be used at 2,600 fpm, and a 600-hp. Nordberg double drum hoist for the cages. The sheave wheels on the headframe are 12 ft. in diameter.

The shaft will be sunk 1,572 ft. Haulage levels, known as D, E, and F, will be established at 796 ft., 1,048 ft., and 1,375 ft. respectively, below the collar. The shaft cross section is 7½ by 32 ft. 4 in. This is divided into a cage compartment measuring 5½x9 ft. inside the timbers; a counterbalance compartment 5½ ft. by 1 ft. 2 in.; two skip compartments, each 5½x6 ft.; and a manway, 5½ ft. by 4 ft. 10 in.

Ground conditions require heavy timber sets, with dividers of 10x12-in. material. Wall and end plates will be of 12x12-in. timber. The first 64-ft. stretch of the shaft is concreted, the concrete collar projecting 1 ft. above the ground.

Shaft sinking is being done on conventional lines. Mechanical mucking was tried but found unsatisfactory because the timber had to be carried close to the bottom, making it impossible to use the units composing the shaft-mucker assembly. Early in June, sinking was hindered by a heavy flow of water encountered at 520 ft. Heavy pumping equipment was installed, and study has suggested grouting of the water-bearing zone before sinking is resumed.

The Kellinske ventilation shaft is being sunk at 55 deg. to a depth of 2,245 ft. The cross section measures 8 ft. by 11 ft. 8 in. To date a depth of 885 ft., measured on the incline, has been reached. Water made is about 1,000 gpm. The shaft has a skip compartment and a manway, measuring 6 ft. 8 in. x 5½ ft. and 6 ft. 8 in. x 4 ft. 2 in., respectively, inside the timbers. All sets are made of 10x10-in. and 8x8-in. material. The shaft is served by a wooden headframe and a single-drum hoist.

When in full operation on a two-shift basis, the Deep Ruth project will furnish 8,000 tons of ore a day to the McGill concentrator, 22 mi. away.

The Kimbley pit is east and about halfway between Ruth and Lane City. Opening of the ore zone containing some 3,500,000 tons of ore calls for removal of 15-million tons of waste. Preliminary stripping was started in November, 1950. Since then more than 10-million tons of waste has been removed. This work is being done under contract by Isbell Construction Co., of Reno.

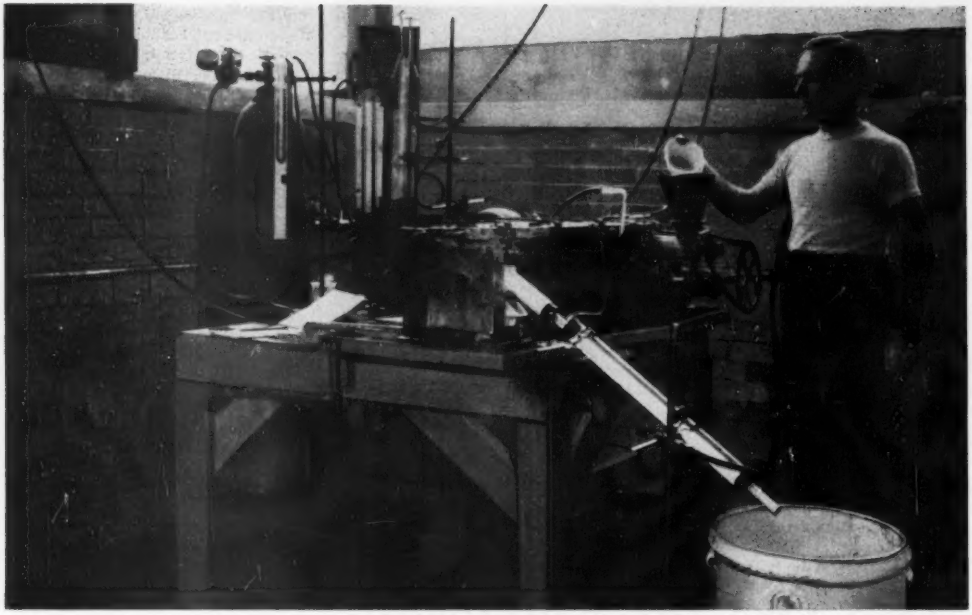
Equipment provided includes Bucyrus-Erie 42-T and 29-T churn drills using 9-in. bits for bench drilling; Euclid 15 and 22-ton end-dump and 25-yd. bottom-dump trucks; 2½-yd. Northwest diesel shovels; Caterpillar D8 tractors with dozer blades; road patrols; service trucks; and other items.

The Kimbley pit project is designed to furnish a daily production of 4,500 tons of ore. It was half-completed early in July. When fully developed, the pit will be oval-shaped, measuring 1,400 ft. along one axis and 1,150 ft. along the other. The ore will be mined in 40-ft. benches, employing conventional churn drill, shovel, and truck equipment. The main-haulage road running between pit entrance and loading siding at Lane City is 3,600 ft. long. Grades in favor of loaded trucks vary from 3 to 5%.

New Pit Planned

The Veteran pit under consideration is near and west of the Morris pit of Consolidated Coppermines Corp. near Kimberly. The area, in which the orebody is to be mined by open-pit methods, has been prospected and worked periodically for high-grade ore by underground methods since 1912.

John C. Kinnear, Jr., is general manager, Kennecott Copper Corp., Nevada Mines Division, McGill, Nev.; Paul Hett is assistant general manager; and S. W. Smith, mine superintendent.



HYDROCHLORIC ACID is the active agent in the author's leaching method for oxidized nickel ores. Shown above is his small-scale continuous-test plant including: digester, HCl cylinder, automatic ore feeder, water-cooled discharge. Capacity is 1,000 lb. of ore daily. Aim was to avoid use of large amounts of coke, sulphur, electric power.

Acid-Leaching Oxidized Ores Offers New Source of Nickel

Remote from supply and distribution channels, the world's oxidized nickel orebodies present formidable treatment problems. Mr. Pawel suggests a leaching technique he believes well-suited to bringing these important reserves into economic production.

GEORGE W. PAWEL
Metallurgical Engineer
Norris, Tenn.

THE INTERNATIONAL NICKEL CO., which began a research and development campaign about 30 years ago to make the world nickel-conscious, has sowed better than it knew for the world is now demanding more nickel than the small number of existing plants can refine (see Table I).

New sources of supply, and new and better methods of extraction, are needed. This article describes a method of extraction that gives promise of utility in treating the world's large oxidized nickel orebodies. These ores are a tremendous potential source of nickel, as yet largely untouched.

New Processes Developed

Owing to the deficiency in nickel supplies, various companies have developed, or are testing, new treatment methods. Among these, the Nicaro Nickel project in Cuba is in production and should benefit by improved metallurgical practices developed since it closed down after the war. In an article, "Nickel and The United States," in *E&MJ* September, 1935, I predicted that these Cuban deposits "may in time account for an appreciable output." The time, long delayed, apparently is now here.

Sherritt-Gordon's development at Lynn Lake, Manitoba (See *E&MJ*, November, 1951) will apply a modified leaching and precipitation technique that, if successful, may be widely used for sulphide nickel ores. At least three other nickel projects of fair size in Canada and Alaska are waiting the outcome of the first year's testing of the Sherritt-Gordon process.

Other processes, as yet only in the laboratory stage, are being studied for use on nickel orebodies in the United States or Canada.

Silicate Ores Available

In contrast to the sulphide nickel deposits, which are found almost exclusively in the Northern Hemisphere, the large oxidized nickel orebodies of the world are confined largely to tropical zones as in New Caledonia, Brazil, the Celebes, Venezuela, Madagascar, and the Southern Urals. Most of them are inaccessible, remote from civilization, supply sources, and markets. If they could be brought into profitable production, the problem of nickel supply would be solved for years ahead.

Any procedure for treating these ores must be simple and must use a minimum of raw materials for refining. All these ores have had the benefit of much research. Each new investigator starts afresh on the same round of beneficiating, leaching, sulphidizing, chloridizing, chlorinating, carbonating, carbonyling, and electric furnacing, which have often been shown to be uneconomic on similar ores.

HCl for Leaching

In our own work on this problem which required the handling of ore containing not over 2½% nickel in a far corner of the South Seas, we eliminated those techniques which called for large volumes of coke, sulphur, electric power and even of the new popular ammonia-leaching chemicals. None of these commodities were available save at prohibitive cost.

Instead we sought a leaching agent which would assure a high and positive extraction of the metal and at the same time lend itself to easy regeneration. Hydrochloric acid appeared best for the purpose, since the strong acid could be depended upon to deliver a high, rapid nickel recovery with cyclic, low temperature return of the leaching liquid.

The basic steps of the process as ultimately devised and patented (U. S. Patent No. 2,468,103, April 26, 1949) provided for the following:

1. Primary hydro-classification of the raw ore for the purpose of freeing the readily friable crystalline fraction from the gelatinuous high-iron fines.

2. Treatment of the coarse crystalline material with strong HCl vapors to dissolve 90% of the nickel and 60% of the magnesia.

3. Neutralization of the filtered nickel-iron-magnesium chloride liquors with MgO to precipitate the iron and nickel as hydroxides.

Table I. Estimated Nickel Production, 1952-1955

Year	Producer	Annual Output Tons
1952	International Nickel Co. of Canada	125,000
1952	Nicaro Nickel Co. (from lateritic iron ores)	15,000
1953	Soc.Anon.Le Niquel of New Caledonia (garnierite)	10,000
1954	Falconbridge Nickel Co.	20,000
1955	Sherritt-Gordon Mines, Ltd.	8,000
1955	National Lead Co., Fredericktown, Md.	1,000
	Total	179,000

The figures given represent the probable yearly nickel production in the Free World, in the period stated. Nickel production behind the Iron Curtain is not likely to exceed 40,000 tons annually, coming almost entirely from the Soviet Union. Of this perhaps 20,000 tons will come from Petsamo, 10,000 from the Urals, 5,000 from Norilsk and 5,000 from East Germany, Czechoslovakia, North Korea, and elsewhere.

4. Combining the No. 3 hydrates with the No. 1 fines for reduction to ferronickel.

5. Evaporation and decomposition of the filtered magnesium chloride solution to MgO and HCl.

Thus the foregoing unit operations involve little more than straight chemical or metallurgical functions, each one of which has been checked and proved on a laboratory scale or larger.

To comment on the several steps, those who have had experience in handling wet, clayey garnierite ore as it comes from the mine can appreciate the advantage of the immediate wash-classification which removes at once most of the troublesome fines and leaves the crystalline minerals in proper condition for further treatment.

While the use of strong hydrochloric acid recommended as a leaching medium has raised misgivings from those unaccustomed to the handling of corrosive chemicals, we have designed and used a ceramic-lined continuous digester which gave no trouble from corrosion during months of operation. The assembly designed to react the coarsely ground crystalline fraction of the ore with high strength (45%) hydrochloric acid vapors in continuous operation, is admittedly the crux of the process and the key to its success.

Unlike the now popular alkaline leaching solutions which require delicately prepared reactive materials, and because of which one can never be sure of uniform metal recoveries, the treatment of the highly basic ore with hot HCl vapors results in an immediate exothermic reaction which leaves no doubt about metal extraction.

Evaporation of the $MgCl_2$ solutions, as we all know, was practiced on a very large scale in our electrolytic magnesium plants during the war. The hydrolysis of the resulting $MgCl_2 \cdot 2\ H_2O$ involves no new technique, unfamiliar to most HCl manufacturers. The decompositions may be expressed thus,

$$MgCl_2 \cdot 6\ H_2O + \text{Heat (140 deg. C.)} = MgCl_2 \cdot 2\ H_2O + 4\ H_2O.$$

$$MgCl_2 \cdot 2\ H_2O + \text{Heat (400 deg.C.)} = MgO + 2\ HCl + H_2O.$$

We also found that by close pH control of the neutralized metallic chloride solutions in step 3, it is possible to separate the nickel from the iron and in a large plant it is probable that at least part of the nickel product would be marketed in pure form. The rest would be sold as a 20-30% nickel ferronickel which envisions a minimum metal slag loss. A newly patented process (U. S. Patent No. 2,573,153, Oct. 30, 1951, L. J. Lichty) recommends use of an aluminum-silicon reducing agent for this application and promises higher-grade ferronickel than commonly obtained with carbonaceous reducers and with similarly low slag losses.

The process also offers a possible valuable co-product in the large volumes of calcined magnesia which will be available. In practice, about 10% of the weight of the original heads would be recovered as a fairly pure magnesia powder. This would have a multitude of uses, as in cements, refractories, chemicals and fertilizers, which may find a market even in the more backward areas of the globe.

Concluding, it is my belief that, if given only a small part of the effort which has been expended on the ammonia leaching processes during and since the war, the foregoing methods would present the opportunity for developing the vast deposits of low-grade silicate ores throughout the world and definitely remove the uncertainty of nickel shortage for years to come.

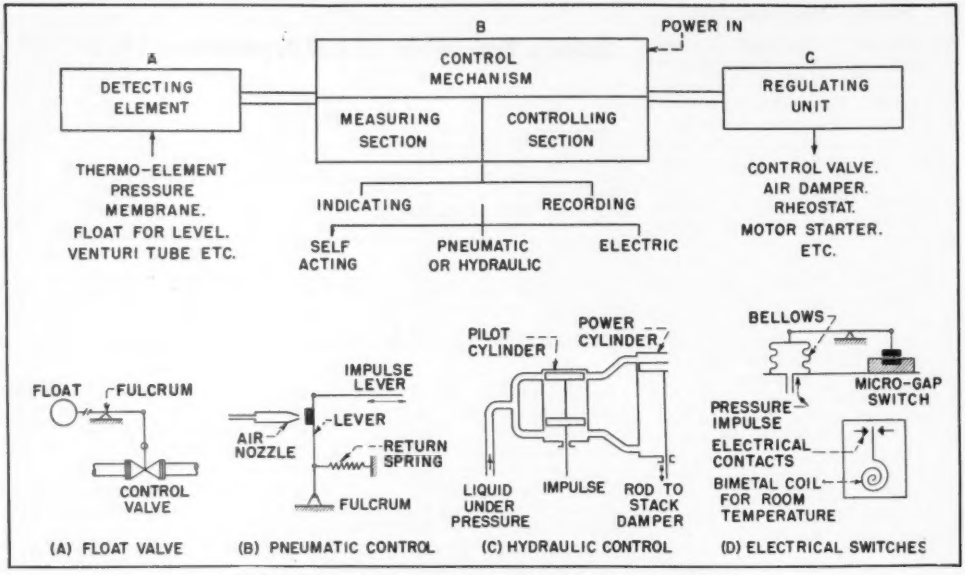


FIG. 1. Elements of controllers and the basic types available.

What Smeltermen Should Know About Automatic Furnace Control

The first of a series of articles dealing with automatic furnace control discusses the economics of installing automatic controls and characteristics of the fundamental types.

LEO WALTER
Consulting Engineer
Cheltenham, England

AUTOMATIC CONTROL in furnaces is on the increase, giving better uniformity of product and achieving continuous effective heat economy. The readiness with which electrical resistors, or oil or gas burners may be adapted to automatic furnace control is a point in favor of modern furnace designs. Nevertheless, a great number of designs of existing and hitherto uncontrolled smelting furnaces lend themselves to practical application of fully or semi-automatic furnace control, and deserve careful investigation as to their controllability. The importance of eliminating the vagaries of the human element impersonated by the furnace operator, from furnace operation requires no elaborate explanation. Today's sturdy and reliable furnace controller types require little attention, are reasonably priced, and usually give years of efficient, uninterrupted service, if properly maintained.

There is, however, one point to be considered when contemplating addition of automatic controls to an existing uncontrolled furnace. An automatic control system cannot improve furnace efficiency. Contrary to general opinion, installation of a temperature controller may limit temperature, but not improve thermal efficiency at all during the first stages of the melting process. The strict ruling must be to put the furnace in proper working order, thermally and otherwise, before installing automatic controls.

The latter will then maintain optimum conditions automatically and continuously. It must be realized that furnace efficiency, embracing thermal efficiency, methods of charging, preparation of the charge, a steady quality of energy or fuel used, and many other factors go hand in hand with controllability of the furnace. To fit automatic controls to a badly designed and/or inefficiently operated furnace can be waste of money. Reconstruct the furnace, or improve certain sections, before installing automatic control. (This reconstruction cost should not, however, be charged against first installation cost of automatic control. It is part of the general maintenance cost of the furnace or can be entered as investment.) After a furnace has been brought to highest possible thermal efficiency, and best possible working conditions, the furnace will be

ready for installation of automatic control gear.

The users of furnace control should be broad-minded regarding financial outlay, but they obviously have to relate cost of control to the expected benefits derived from automatic control. In dealing with economics of automatic control of smelting furnaces, the many advantages offered by installation of automatic control instruments cannot always be correctly assessed in exact terms of improved product quality of, or fuel and labor. It is also somewhat difficult to balance first installation cost of an automatic furnace control system against trouble arising from prolonged batches, or against loss of quality of a batch caused by inattentive furnace operation. Nevertheless, some yardstick has to be found for financial justification of installation of furnace control, whether for putting additional controlling instruments to an existing furnace, or when a decision has to be made on how far instrumentation in general, and automatic control in particular, should go.

Economy of heat input is, however, not only confined to the use of solid, liquid or gaseous fuels, or to electrical energy, but also to other factors, such as proper insulation, proper gas movement, correct distribution of heat and the like. The thermal benefits of automatic furnace control can be greatly increased by proper furnace operation in general, the use of best possible and economical fuel, and other factors. On the other hand the best and most expensive instrumentation can be made less efficient by poor furnace operation.

Justification of Controls

For a new furnace, the total cost of which should be A dollars without automatic control, but including the necessary measuring instruments, the additional cost for automatisation of operation should be B dollars. It is customary to express B as a percentage of A, and this percentage may be 1% or 2 or 3%, or more. The instrument manufacturer will usually give a certain guarantee as regards achievable fuel or energy economy, based on his experience with similar installations. If this guarantee keeps within, say 50% of the agreed figure of B, it can be usually safely assumed that the investment is sound. Three reputable instrument making firms should be invited to submit estimates and after being

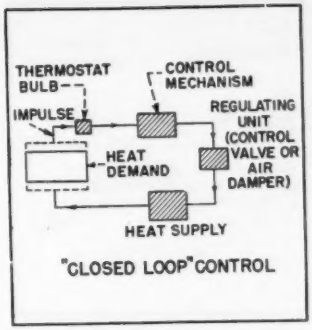


FIG. 2. "Closed loop" control.

brought to the same or similar specification, their guaranteed fuel savings should not differ by much.

First installation cost must not, and cannot be the only yardstick for selection and decision on make and type of controls, because what can be gained on first expenditure might be lost in reduced accuracy of control, and in increased maintenance costs. Sturdiness, reliability, and freedom from excessive maintenance expenses should, therefore, be in the forefront for consideration.

The simple formula for justification of automatic furnace control will, therefore, be:

$$C = XA + B.$$

Where C is the cost of automatic control, A the total furnace cost; X a percentage assumed for imponderable savings by the instrument makers; B the cost of the instruments.

For existing furnaces, a similar formula can be applied, but there are less difficulties for guessing the value of the factor X. The furnace log book, occasional or regular tests, and figures available from the accounting department allow a fairly shrewd guess as to expectable fuel savings. The justification for existing furnaces is:

$$C = AX + B + Y$$

where the factor Y is related to furnace reconstruction cost necessitated by requirements for improved controllability.

Y might include the cost for improved insulation, for exchange of a gas or oil burner to a better controllable type, or for means for better heat distribution. Replacement of a new stack damper, however, in connection with draught control would be debited to cost of furnace improvements, and not to furnace controllability.

Fundamentals of Automatic Furnace Control

The basis of automatic control of any industrial heat flow process in general is measurement. Semi-automatic control will measure all essential operation factors, but only the most important will be controlled by means of automatic gear. Fully automatic control converts the operator to a supervisor.

Looking at a smelting furnace as a way to admit heat to the material, the process to be controlled is usually flow of heat from a "heating medium" to a "heated substance." The main controlled factor or "process variable" will, therefore, be temperature, although other variables, such as draught and furnace atmosphere might also come into the picture. Thermostatic furnace control is thus a single variable control problem, but where other factors have to be simultaneously controlled, the multi-variable problem requires "engineered" control, whereby several processing factors have to be co-ordinated during all control actions. For example in combustion control of temperature, volume and composition of combustion gases have to be coordinated to furnace draught and temperature.

The user of control instruments should be familiar with the expressions of "control cycle" or "closed loop" of control, which deals with the chain of control actions on part of the instrument and the reactions from the controllable variable, as shown in Fig. 2. The main point to be realized by the potential user of automatic control instruments is that the controlled furnace itself is part and parcel of the control cycle or closed loop system, and accuracy or closeness of control, depend not only on the type, size and installation of an automatic control instrument, but to a very great extent on furnace characteristics. "Furnace controllability" is, therefore, a factor which most decisively influences every control problem.

In this connection, I quote the following from the standard work in *Industrial Furnaces* by Professor Trinks, expressed at the end of the chapter on "Control of Furnace Temperature:"

"There is undoubtedly a great field of usefulness for temperature control devices, but prospective users should understand that it is control of temperature of product and not of furnaces that is needed; that there are many furnaces which will not permit control of heat ap-

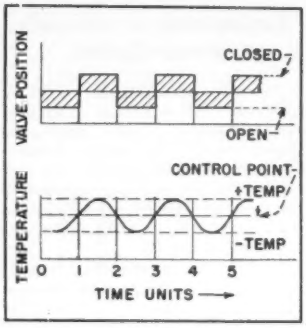


FIG. 3. "On-Off" control of heat supply.

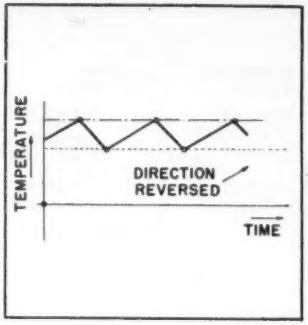


FIG. 4. Floating control varies with temperature.

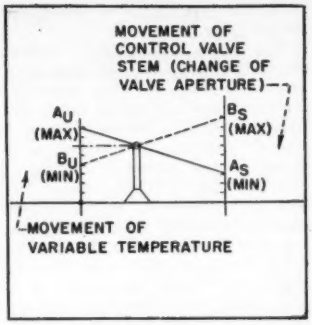


FIG. 5. Adjusting valve on gas burner gives proportional control.

plication, although they may permit control of furnace temperature."

Control Fundamentals

Fundamentals of automatic control of smelting furnaces are not different from any other application of control theory, and a simplified non-mathematical approach can be made to control problems. Automatic control of process variables such as temperature, draught or pressure, rate of flow, aims to keep a physical condition or quantity at a desired value. This value may be constant, or it may vary according to a predetermined relation. The control actions required are: (1) measurement of the physical condition or quantity, (2) comparison of the value derived from measurement with the desired value, and (3) moving a regulating unit to achieve the desired value or control point. Between stages (2) and (3), power amplification is usually required in an automatic control system or closed loop. The fundamental requirement for any control mechanism and regulating unit is that their characteristics must match process characteristics, which depend mainly on process controllability and time lags.

Before dealing with the elements of various controlled types used in smelting practice, it seems appropriate to present to the mining engineer the way in which the instrument engineer looks at control problems of furnaces. This method of presentation will disclose the importance which process time lags play in achievement of accuracy of control, and will also stress the point that the inherent resistance of a furnace against control makes precise control difficult. No matter what the potential user of automatic control wishes to achieve, and irrespective of desirable closeness of control, both the design and actual working operations of the furnace limit achievement. It would be futile to expect precise control from a furnace which has little self-regulation, i.e., offers great resistance to the effect derived from adjusting the regulating unit, for example movement of an oil supply control valve to an oil burner, or to the action of the air and gas valves of a gas burner having air-fuel ratio control installed.

The most widely controlled process variable, furnace temperature is also most difficult to control because of delays and retardations during the heat flow process. Actually it is the temperature of the charge rather than the temperature of the furnace atmosphere, which needs control. As temperature is determined by a balance between heat input and heat outflow, the temperature gradient of rise or fall depends on various factors, like specific heat of material to be smelted and on barriers to heat transfer. Furnace design aims to keep temperature uniform throughout the charge or stock, but in practice there are distinctly different zones of temperature to be expected until the process of smelting is far advanced. This brings up the question where to measure temperature.

Exceeding the best suitable temperature is not good thermal economy, but location of a temperature detecting element is not always at the actual point where the best suitable temperature could be detected. It is, however, possible to measure and to control a temperature strictly related to the critical temperature of the charge, and this method of "indirect" temperature control is often applied.

Two basic methods can be applied for preventing excess temperature. One main group of control uses intermittent heat input, whereby during a time interval full rate of heat input is applied, but is cut off once this temperature has been reached. (Fig. 3). This mode of control, based entirely on time is called "two-step" mode. One subgroup is the widely used "on/off" or "open and shut" mode. Another sub group is "high-low" for gas-or-oil burners. Three-step mode is then "high-medium-low" position of the burner. Multi-step control employs, as the name implies, several positions between fully open and fully closed on the control valve to the burner, or a multitude of contacts to an electrical relay connected to resistors of an electric furnace.

Floating Controls

A control mode which is called "floating" is used by itself, but sometimes forms an important component of high control modes (Fig. 4). An example is a contact pyrometer actuating a motorized control valve to an oil burner, closing and opening at certain periods of time. The floating method is one in which the rate of movement of the control valve or means of regulation is proportional to the control error, or deviation from the desired value. Expressed mathematically the valve position is proportional to the integral of the control error. $P = K_1 \int E\,dt$, where P=Valve position: E=Control error; K_1=Sensitivity factor; t=time.

The term "floating" is applied because the control valve might be fully opened or fully shut at *different* temperatures during its cycling, and actually achieved temperature will float between varying values.

The third main group of control is called "modulating," or "meter-

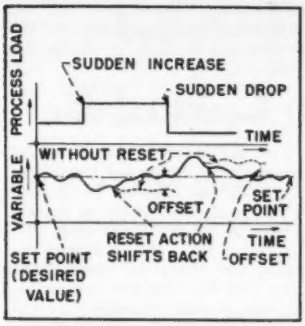


FIG. 6. How instrument "drift" develops with heat load changes.

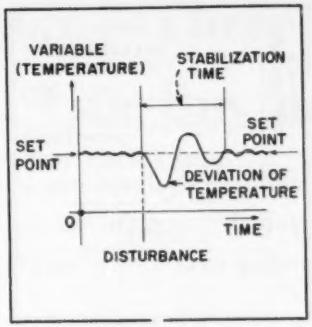


FIG. 7. Stabilization curve for higher modes of control.

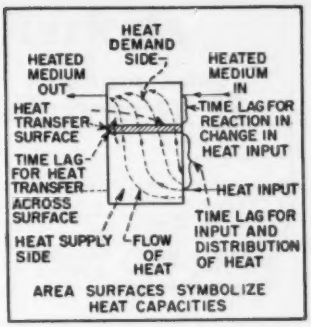

HEAT DEMAND SIDE
HEATED MEDIUM OUT
HEATED MEDIUM IN
HEAT TRANSFER SURFACE
TIME LAG FOR REACTION IN CHANGE IN HEAT INPUT
TIME LAG FOR HEAT TRANSFER ACROSS SURFACE
HEAT INPUT
TIME LAG FOR INPUT AND DISTRIBUTION OF HEAT
HEAT SUPPLY SIDE
FLOW OF HEAT
AREA SURFACES SYMBOLIZE HEAT CAPACITIES

FIG. 8. Time lags in heat exchange through furnace walls.

ing," or "gradual." Its simplest form is the proportional method. In this the valve position is proportional to the control error or deviation from the desired value, or expressed mathematically: $P=K_2E$. Fig. 5 illustrates the strict relation between temperature and valve opening, but it should be realized that valve opening in itself does not ascertain the same desired value of process temperature under all circumstances. What is called "load factor," "offset," "drift," "droop" or "wandering of control point," is the result if proportional mode of control is applied to unfavorable process conditions. An example is varying gas supply pressure to a burner, which will cause plus offset with higher heat supply pressure, and minus offset with lower (Fig. 6) supply pressure than normal. A sudden disturbance of load conditions on the heat demand side of a process can also produce load error. For example adding a charge during the melting period, will establish with proportional control a minus offset condition, i.e., control at a lower temperature than the desired temperature set at the control instrument.

More elaborate gradual controls using a proportional component, but having back-feed for corrective actions have been developed, for example, "reset mode", also called "integra" or "first-derivative" method. (Fig. 7). In this system, the control valve position is proportional to the rate of change of the control error or deviation from the desired point. Expressed mathematically the valve position is proportional to the first differential of the control error.

$$P=K_3\frac{dE}{dt}$$

In a floating and proportional controller, the valve movement is proportional to the combined effects of the floating and proportional methods. Expressed mathematically the valve position is proportional to the algebraic sum of the floating and proportional effects;

$$P=K_1\int Edt+K_2E.$$

If the control error is positive, i.e. meter reading above the desired value, and it is still rising, both the floating and proportional effects will cause the valve to move towards its low position. But if the control error is negative, i.e. meter reading below the desired value, but rising, the floating and proportional effects are in opposition. The floating method will require the valve to travel towards its high position, since the meter is registering below the desired value, but the proportional method will lower the valve position as the meter rises.

In a floating proportional and first-derivative controller, the valve movement is proportional to the algebraic sum of all three effects;

$$P=K_1\int Edt+K_2E+K_3\frac{dE}{dt}.$$

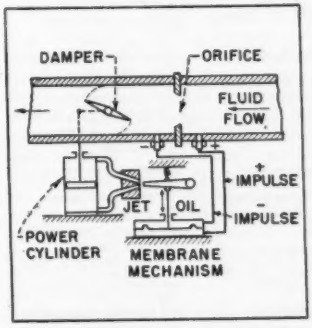


FIG. 9. Hydraulic method of flow control produces floating control.

Which Control To Use

Factors influence the choice of control methods are: (a) required accuracy of control on part of the user; (b) controllability of the furnace; (c) characteristics of the control instrument itself. A large process time lag between detection of excess temperature and coming into action of an appropriate counter measure, i.e. throttling of a control valve, or increase of resistance of resistors etc., makes auto-control less accurate. The more controllable a furnace is, i.e. the smaller its inherent time lags are, the more flexible will it be to changes of rate of heat input, and the better will control results be (Fig. 8).

How To Determine the System Required

A plant that has one major lag (known as a first order lag) is easy to control by the proportional or floating and proportional methods, and no improvement will result if the first-derivative method is added. Typical plants having first order lags are most pressure control problems, i.e. reducing valves, etc., and some level control. This type of lag can be recognized by the immediate response of the meter to a movement of the control valve, even though some time may elapse before the meter reading finally steadies out.

A plant that has two lags in series (known as a second order lag) is more difficult to control, but can usually be dealt with satisfactorily by the floating and proportional methods (Fig. 9). A typical example is simple flow control, in which the first lag after opening the control valve is concerned with the increase in pressure downstream from the control valve, while

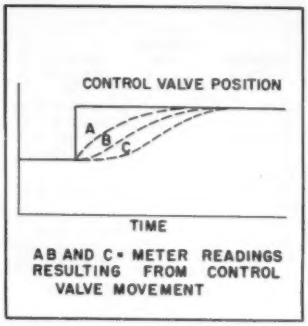


FIG. 10. An instrument responds differently for various orders of lag.

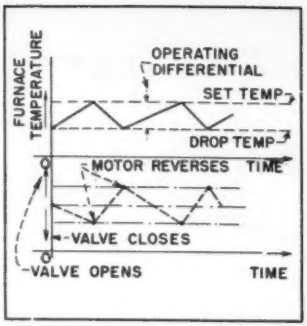


FIG. 11. Thermocouple, motorized burner valve give floating control.

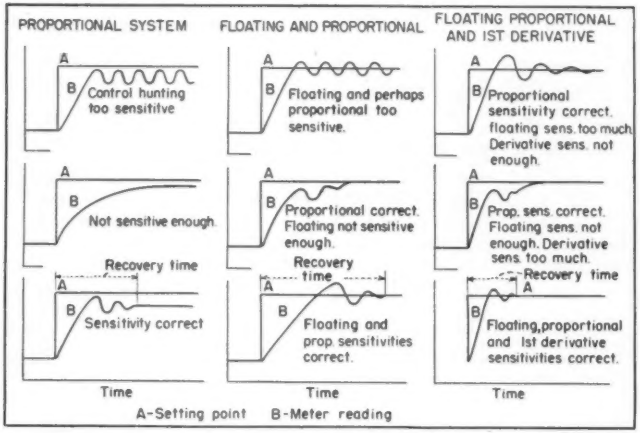

PROPORTIONAL SYSTEM
FLOATING AND PROPORTIONAL
FLOATING PROPORTIONAL AND IST DERIVATIVE
Control hunting too sensitive
Floating and perhaps proportional too sensitive.
Proportional sensitivity correct. floating sens. too much. Derivative sens. not enough.
Not sensitive enough.
Proportional correct. Floating not sensitive enough.
Prop. sens. correct. Floating sens. not enough. Derivative sens. too much.
Recovery time
Recovery time
Recovery time
Sensitivity correct
Floating and prop. sensitivities correct.
Floating, proportional and Ist derivative sensitivities correct.
Time
Time
Time
A-Setting point B-Meter reading

FIG. 12. Different modes of control show different characteristics in restoring furnace to desired control point after a change in load.

the second lag is concerned with the acceleration of the fluid resulting from this increase in pressure. The response in meter reading after a movement of the control valve on a plant having a second order lag is shown at "B" (Fig. 10).

Effect of Lags

Plants with three lags in series (third-order lag) or four lags in series (fourth-order lag) are still more difficult to control, and can be improved by the addition of the first-derivative function. Some temperature control problems are typical examples of such plants. The response of the meter reading to a movement of the control valve is shown in Fig. 10 at "C", from which it will be seen that the meter reading commences to move off slowly after the control valve has been moved, and then it accelerates before finally steadying out. If one of the lags happens to be large in comparison with the others, its effect will partly swamp the remaining lags, making the control problem easier than it would have been if all lags were of similar value.

It should be noted that, if the measuring instrument, and the control mechanism have considerable lag, these lags must be added to the plant's lag. That is, if a flow control problem is tackled with a meter having a lag of approximately equal magnitude to the plant's lags, the effect as far as the control problem is concerned would be to raise the total lag to one of the third-order type. However, if the meter lag is increased artificially (as is sometimes done by throttling the "U" tube of a mercury operated flow meter), the meter lag can swamp the plant lag, and render the control problem less difficult. With such an arrangement, the flow could change quickly and be undetected by the meter, but on most applications this does not happen, and the method can be used to obtain stability.

Sensitivity Adjustment

Two major requirements of an automatically controlled plant are: (1) That the variable be returned to the desired value as quickly as possible after a disturbance. (2) That the control system be stable, i.e., show no tendency to hunt. The two are not compatible since an increase in sensitivity will improve (1) at the expense of (2), and vice-versa. The various methods of control described above each have their particular advantages in favor of either (1) or (2).

Stability of Control

Floating control always returns the measured variable to the control point, but it is a relatively unstable system (Fig. 11). Proportional control is a much more stable system, but does not necessarily ensure that the measured variable is always at the desired control point under various conditions of load. On the other hand, a derivative control is a very stable system of control, but it is not concerned at all with the absolute value of the controlled variable.

From the above, it will be seen that the overall sensitivity of a particular method of combination of control methods becomes a compromise between the requirements of returning to the control line quickly, and stability. Also, that the relative sensitivities of the methods employed in a combined system are also a matter of compromise to ensure the same control results.

A most instructive set of curves for a proportional, a floating and proportional, and for a floating, proportional, and reset (first derivative) controller is illustrated in Figs. 12-A, B and C. The curves "A" show process load, having a sudden disturbance (for example additional batch of furnace charge). The curves "B" show how the various controllers react, and what the "recovery" time is in each instance, i.e., after which elapsed time period the desired process temperature has been re-established. A study of these curves will probably contribute to the knowledge of the often used but often abused term of "sensitivity" of a control instrument.

A second article in this series will deal in more detail with the elements of furnace control systems.

Gold Today—Three Markets Where You Can Buy and Keep It

Just back from Tangier, Paris, and London, Mr. Bratter, well-known writer on monetary matters, tells how gold moves internationally and how hoarders can buy it.

HERBERT M. BRATTER
Washington, D. C.

IN A WORLD dominated by economic and financial controls, the individual desiring to put some of his savings into gold as a hedge against currency depreciation needs to know a lot about the facilities available. Recently, I had occasion to visit three cities which, each in its own way, play a part in that world-wide network of gold producers, fabricators, dealers, black-marketers, hoarders and others who constitute the free gold market.

Tangier, Paris and London are three way-stations on the roads followed by the much prized yellow metal in its halting yet perpetual travels around the world. I found the differences, and similarities among these three markets fascinating.

Tanger is unique in the freedom which it offers foreign gold, and indeed capital in any form, to come and go as it likes.

Paris offers an entirely free and anonymous market in gold to residents of France as well as facilities for gold in transit. The French "internal" gold market is not without connections with outside gold markets of darker hue, if not through arteries, then through capillaries.

The London gold market of yore, while now relegated to the sidelines, still coaches in the world gold game and even manages to profit therefrom without visible disturbance to that now rather bureaucratic "Old Lady of Threadneedle Street," the Bank of England.

Tangier—A Haven

The international zone of Tangier in northwest Africa, a haven for capital from all the continents, boasts a completely free market in foreign currencies and gold. Gold in transit may be stored in Tangier indefinitely without payment of duty. Such gold may be stored in the vaults of any of a number of recognized banks of the city. Of Tangier's 67 banks, about 15 may be considered as regularly in the gold market; and about half a dozen brokers deal regularly in gold. One bank, Swiss-owned, the Société de Banque Tangéro-Suisse, issues gold certificates in bearer or registered form. Tangier gold may be bought with any currency, there being in that zone no form of exchange control. In addition to transit gold, there is also a market in Tangier for duty-paid gold called gold *deduané*. The import duty is 7½%. Some gold is imported for use in the arts; and other gold on which duty is paid finds its way overland into forbidden territory.

Whereas Paris has a free market legally open only for domestic trading and other places like Beirut have a free market for transit gold, in no other market, Tangier bankers state, are the formalities so few as in Tangier. About 20 banks are recognized by the Tangier customs as gold depositories for transit gold. There is no American bank in Tangier.

During World War II Tangier temporarily lost its international character when Spain, seeing an opportunity, took control while the other control powers were preoccupied with the conflict. The Spaniards, however, observed the amenities and never entered any of the banks.

Tangier's economic growth dates from 1945, when international control was restored. During the postwar period much capital has fled there from Europe and elsewhere to escape high taxes and controls. Some of this outside money has been invested in Tangier mortgages and real estate, some in gold, and some has been re-exported from Tangier to third countries.

Gold held in Tangier for foreign account subject to ultimate re-exportation is described as held in *entrepôt fictif*. The banks recognized by the customs as depositories for such gold keep the metal earmarked for their customers' accounts. Thus, in the bank vaults each bag of coins or bar is segregated under the labels *deduané* or *entrepôt fictif*. Careful record is kept and published on imports and exports. Customers pay purchase and handling charges as well as storage and insurance.

The free exchange market in Tangier is a vital part of the city's gold market, for through it the proceeds of gold sales may be converted into various currencies and transferred.

Tangier Gold Movements

At the end of June, 1952, gold in *entrepôt fictif* in Tangier totaled 47,754 kg., a net reduction of 1,700 kg. during the preceding six months. Little gold seems to have been frightened away from Tangier by the rioting of March 30, 1952. Movements of gold since the establishment of the *entrepôt fictif* in Tangier are shown on p. 103.

Gold moves to Tangier from the chief European transit points and many others. During the last quarter of 1951, 2,976 kilos of Tangier's total imports into *entrepôt fictif* came from the United Kingdom. France was the next largest supplier, 1,516 kilos. Smaller amounts came from the Netherlands, South Africa, Belgium, Germany, Switzerland, the USA, and Tunisia in that order. During the first quarter of 1952, the main suppliers of the Tangier market were Colombia, France and the USA. A minor part of the gold shipped from the USA came to Tangier by way of Switzerland and the Netherlands.

How Gold Is Held

Only one Tangier bank, the Société de Banque Tangéro-Suisse, issues gold certificates. The certificates were introduced in 1950 and have found some market in Europe. It is not believed that any large quantity is outstanding in the United States, although it is entirely legal for Americans to hold gold abroad. (See p. 102.)

The bearer certificates at first

(Please turn to p. 103)

THIS BANK IN TANGIER, into which men are carrying gold, will sell it, give buyer certificate, keep metal for him.

Certificat d'or · Goldzertifikat
SOCIÉTÉ DE BANQUE TANGÉRO-SUISSE
TANGER
FRANCS 1000 POUR KILO
7390, AVEC CERTIFICAT D'ESSAI DE LA DEGUSSA DU 13 AVRIL 1950
31 DÉCEMBRE 1951
MONSIEUR KURT ACHERMANN
BAHNHOFSTRASSE 20, ZURICH
Tanger, le 10 OCTOBRE 1950
SOCIÉTÉ DE BANQUE TANGÉRO-SUISSE
- SIGNATURES -

BANK'S CERTIFICATES, facsimile above, are in name of owner or are "bearer" certificates, freely transferable.

How To Own Gold Without Breaking the Law

An interview with Mr. F. C. Lichtensteiger, managing director of the Societe de Banque Tangero-Suisse, Tangier, North Africa.

1. How could an individual in the United States, for example, buy gold from you?

Simply by ordering from us gold certificates in whatever amount he wishes. We issue them in "denominations" equivalent to gold bars weighing 100, 500, and 1,000 g. and 12.5 kg. The buyer pays the current Tangier open market price plus 2% on 12.5 kg. bars or more, and 3% on smaller bars. We also issue certificates against deposits of gold coins.

If the free market price is $37.50 per oz., the buyer of 12.5 kg. bars would pay $38.30 per oz. This premium includes our commission and storage charges for the remainder of the calendar year of purchase and the entire next year. The owner pays $5 per kg. per year thereafter to cover storage and insurance.

2. Are these certificates transferable?

We issue two varieties: the "bearer" gold certificates are as freely transferable as money; the "registered" certificates, in the owner's name, are transferable by endorsement. The owner can shift from one to another.

The gold behind the certificates is at the owner's disposal and may be shipped to any part of the world, except where local laws prevent it, at his order.

3. Where, outside Tangier, can gold be held for an absentee owner?

In Mexico, South Africa, the United Kingdom, Uruguay, Canada, and Switzerland, among others. In the last two some real or potential barriers must be considered.

4. How can an American pay you for a gold certificate?

By depositing to the credit of the Societe de Banque Tangero-Suisse at the Chemical Bank & Trust Co., 165 Broadway, New York, N. Y., the approximate dollar value of the gold to be bought. At the same time he should airmail me the details of what he wants to buy and where he wants the certificates sent. We have a folder available giving particulars on such transactions.

5. How does the buyer know the gold is where the certificate says it is?

Our gold holdings and issuance of certificates are audited by Price, Waterhouse & Co., of New York, at irregular intervals of their own selection. We hold all gold behind outstanding certificates as the sole property of the owner and always available to him. If the owner obtains from us an advance against the gold, the metal is duly earmarked. Insurance against fire and theft is provided by British and American insurance companies.

6. What happens if there is a war?

Who knows how another war might affect Tangier? If you were holding gold with us, and if you thought a war likely to affect Tangier were imminent, you should at once move the gold to some other country, such as Canada.

7. Then why not buy gold in Canada in the first place?

Because Tangier enjoys a unique and free gold market. Canada does not. Gold is not quoted daily and dealt in freely in Canada. Without such a market, one cannot buy and sell gold certificates. A gold certificate can be sold by a bank only when the bank holds the gold it represents. This bank is the only institution of world repute that sells gold certificates and is able to handle the traffic.

You cannot buy gold freely in Canada, but you can ship it there for safekeeping. By acquiring a certificate in Tangier, representing actual gold, one is relieved of all details. One can dispose of the certificate by sale, transfer, or redemption at any time. The certificate is a negotiable deposit receipt, quite different from an ordinary safe-deposit receipt.

met with some objections on the part of the National Bank of Switzerland on the grounds that they might compete with the national currency. It was determined, however, that the certificates do not encroach on the central bank's note issue prerogatives.

Bearer gold certificates, which are issued in various "denominations," are freely transferable. Registered certificates may be transferred upon endorsement. Certificates are issued for gold bars of approximately 100, 500, 1,000 and 12.5 kg. Certificates are also issued against deposits of gold eagles, sovereigns, napoleons and other coins.

The 12.5 kg. gold bars behind the certificates are of at least 995 fineness; smaller bars are of pure gold. Assay of the latter is by the *Deutsche Gold und Silberscheide Anstalt* of Frankfurt, Germany.

Why Frenchmen Hoard

Gold as a store of savings has been favored in France since the memory of man runneth not to the contrary. Since World War I, according to Professor René Digne of the Paris Law School and School for Political Science, new factors have changed the character and volume of gold hoarding in France.

Previously gold hoarding was prevalent only among the least cultivated, rural classes, who put away gold coins possessing legal tender. For these coins the hoarders paid the face value and no more.

Nowadays gold hoarding in France is practiced mostly by well-informed persons thoroughly familiar with all the available media of exchange and investment.

An avalanche of radical developments drove the French people to hoard gold. Widespread planning in an atmosphere of economic and financial disorder; successive depreciations of the franc ruinous to holders of franc assets; imposition of confiscatory taxation even on persons of medium-size means and regressive taxation on lower income groups; the solidarity tax; the unanticipated stamping of Treasury bonds; the calling in of banknotes for exchange, followed by the cancellation of 5,000-franc notes; nationalization of various industries and additional threats against private property; and finally, the jumble of endless formalities applied to all regular operations: to these developments Prof. Digne attributes the wide resort of Frenchmen to gold hoarding. It seemed to offer the only means of protecting private assets.

How Gold Moved Into Tangier When Encouraged

Year	Entries into *entrepôt fictif*	Withdrawals for export	Entries (duty-paid) for consumption.
1948	6,583.6	1,904.7	283.3
1949	15,017.0	8,696.9	689.5
1950	28,395.1	7,065.4	1,492.6
1951	24,212.0	5,248.0	1,172.0
1952 (Jan.-Mar.)	2,313.0	3,117.0	112.0
1952 (Apr.-June)	446.0	1,205.0	25.0

Legalized Black Market

Large-scale private gold hoarding in France was illegal prior to the law of Feb. 2, 1948. When it comes to taxes and government regulations, the Frenchman is perhaps not the most law-abiding person in the world. The long Nazi occupation during the war made evasion of authority and resort to black markets positively patriotic.

This attitude continued through the period of postwar instability. The evolution of the black market in gold was a convenient development for those large operators who ran the black markets in foodstuffs, commodities, real estate, rentals and foreign exchange. For the French gold market, be it black or legal, both draws from and feeds the gold markets of other countries and therefore necessarily has its counterpart in the foreign exchange field.

The successive French governments found themselves helpless to suppress the black market in gold. In 1947 a campaign for legalization of private gold trading made its appearance. Economic conditions, helped by the Marshall Plan, gave promise of improvement, which, it was argued, would eliminate the hazard premium at that time incorporated in the price of gold. Official publication of low and stable gold prices would, moreover, tend to restore confidence in the currency.

Overcoming serious difficulties, the French Government freed the holding and transportation of gold in French territory and one month later, on March 1, 1948, decreed legal anonymity for all buying or selling gold. Because this legislation recognized gold prices at variance with the franc's official parity and also authorized a free market in certain foreign currencies, the new French policy encountered the strong displeasure of the dominant figures in the World Fund. Liberals in France hailed the new market as a blow at economic planning, which certainly it was. Not only was the Bretton Woods goal of a centrally-managed world breached; both future and past gold hoarding, theretofore illegal in France, was given government sanction. The free gold market, it was hoped, would encourage the repatriation of French capital abroad, while providing a quasi-official market for private foreign-exchange transactions.

Hoarders Classified

Professor Digne lists three classes of French gold buyers. First are the professionals and semi-professionals. In this category are included, presumably not only the arbitrageurs seeking a short-term profit, but those engaged in illicit trade in commodities or illicit capital movements and to whom gold is an essential medium for effecting their ends.

Second are those who buy gold in anticipation of monetary depreciation, financial disturbance or the like in the not distant future.

Third and most important are the long-term investors who put their savings into gold on general principles. Such persons are of every social and economic class, down to the little fellow who can afford only a 10-franc prewar coin.

Above the premium at which gold ingots sell in France is the special premium placed on gold coins. This arises from the fact that a coin is a convenient, small package of known content and ready disposability. It is a mighty handy medium for storing the profits of law evasion, and there are plenty of restrictive economic laws to evade in France, including income and inheritance taxes, customs duties, trade restrictions, etc.

The free gold market takes place each business day from 12:30 to 1:15 pm in a special chamber of the

Bourse in Paris. All foreign-exchange agents, stockbrokers, and certain banks and financial institutions have access to it. They number about 130 altogether, two of them operating for the Bank of France and the French Treasury.

According to Prof. Digne, the latter intervene in the market with outstanding skill and effectiveness, decreasing divergencies which may appear in the various categories of gold quoted by buying or selling, as the case may be, but without opposing the dominant trend.

Traded daily are various issues of French and foreign gold coins, as well as bars and ingots in minimum quantities of 75,000 francs. The names of the principals are never known to the Bourse or government authorities. Volume of transactions varies from 200 to 3,000 kg. per session, a volume commensurate in value with that of securities traded on the Bourse. In terms of francs, gold transactions of the Paris Bourse total about 1,-billion francs a day. The total for the full year 1950 was about 200 billion francs.

French Hold Billions

While no one knows how much gold is privately held in France, the total is believed to compare favorably with the value of all securities listed on the Paris Bourse. In early 1949 the Bank for International Settlements at Basle estimated French privately-held gold at $2½-3 billion.

While coins are preferred to the 1- and 12-kg. bars traded on the Paris market, not all coins are equally prized by hoarders. French coins, like the napoleon and the louis d'or, sell at premiums as compared with corresponding Belgian, Dutch or Italian pieces. In its stabilization operations on the Paris market the Bank of France, manager of the French Stabilization Fund, does two-thirds of its gold business in coins. "Old" louis d'or are currently struck for this purpose; that is, gold coins bearing old dates. This can be very profitable to the Stabilization Fund. At one time last year the premium on gold coins over bars was more than 40%.

While gold moves out of France at times, the preponderant movement since World War II is believed to have been toward France. Paris is the destination of much of the "industrial gold" which South Africa and other countries have been marketing in disregard of the wishes of the larger members of the IMF. Even before the establishment of the free market in Paris in 1948 French customs officers seemed reluctant to interfere with gold smuggling. Gold "arrivals" on the black market were openly referred to in the press.

The higher the Paris premium, the greater the inducement to bring gold into France from abroad. A substantial fraction of newly mined and other gold offerings has found its way into France via such trading centers as Milan, Amsterdam and Tangier.

Since gold sellers naturally demand hard currency for their commodity, the French buyers or their agents must patronize the black markets to get their exchange. To acquire foreign exchange in the absence of foreign assets which can be liquidated means avoiding export and exchange controls by one device or another. Obviously, the French official balance of international payments cannot take account of the economic resources involved in the business. *When the French present to the American Government their annual dollar deficit, the American taxpayer indirectly finances the private hoarding of gold by Frenchmen.*

A premium of 4% in Paris is reported to suffice to induce illegal international movement of gold. Stopping the illegal movement is virtually impossible, a French official told me.

One other subtle attribute of the traditional gold standard is claimed for the hoarded French gold: that it curbs reckless government finance. The hoarded gold, Prof. Digne holds, serves to a certain extent as cover for the note issue, since the sensitiveness of the Paris market will always curb the economic and financial fantasies in which governments and parliaments may wish to indulge. That is, the authorities could not remain indifferent to the prospect of a loss of confidence in the franc as reflected in a soaring price of gold on the free market, induced by reckless fiscal policy; nor dare they eliminate the free gold market to remove that benchmark of confidence.

London's Gold Facilities

British exchange control does not permit revival of the gold market in London. None the less, London is still the repository of an unknown but doubtless considerable amount of gold owned privately outside the United Kingdom. Asked to name the safest place for an individual abroad to hold gold, an officer of one of London's old bullion firms replied, "London."

Approximately half a dozen such firms with vaults on their premises are holding gold in bar and coin form for foreign clients.

Foreigners may send gold to London at will for safekeeping and, as has been the case throughout the period of British exchange control, may withdraw it from Britain at will. An export license is required, but this has always been a mere formality obtainable in 24 hours, according to the bullion firms. Thus, London is in competition with Tangier, South Africa, and various Latin American countries for the custody of the private hoarder's gold.

British bullion experts I inter-

(Continued on page 170)

Privately-Minted Gold Coins Win 30% Premium

PRIVATE GOLD COIN minting in Europe was started about two years ago in Italy, when French napoleons of absolute correct weight and mint were first produced on a large scale.

As these operations yielded fantastic profits, more enterprising men went into this business.

A number of government mints also accepted "coining orders," provided the client delivered the gold and paid a 2% to 3% minting fee. This fee advantageously compared to the free market rate of coins which usually sold 30% and more above the price of bar gold. It gave the manufacturers an amazing margin, which neither the regular gold trade or any other financial business could grant.

During the last year, the private minting of napoleons, sovereigns, ducats, 20-mark coins, centenarios, etc., has reached unexpectedly large proportions. Many central banks deal directly or through special and confidential brokers in these "new coins."

A few governments have tried to stop this embarassing trade. One of them tried two "manufacturers" in a Swiss court and lost the case, to the amusement of a laughing world, which pays the highest respect to the Swiss Federal Court of Geneva and its judgment against the Italian Government.

It is quite possible that private minting of gold coins, estimated presently at more than $100,000 a day, will gain in output and continue to embarass many governments.

Taken from the September, 1952, issue of "Pick's World Currency Report," New York, N. Y.

Agencies of the Federal Government That Have a Significant Interest in Strategic and Critical Metals and Minerals (September 1952)

Compiled by JOHN D. MORGAN, Jr., E.M., Ph.D.

The President

Executive Office of the President

The White House Office—Advises the President on legislation, organization, and other problems.

Office of the Special Assistant to the President—Advises on foreign development programs.

***Office of Defense Mobilization (ODM)**—Establishes general mobilization policies, including policies for the expansion of industry.

Bureau of the Budget (BB)—Reviews budget requests for defense production programs, stockpiling, and functions of the agencies concerned with metals and minerals. Secures coordinated views of the Executive Branch regarding legislation. Establishes necessary organizational patterns.

National Security Council (NSC)—Advises as to the imminence of war and reviews broad security programs, including stockpiling.

Central Intelligence Agency (CIA)—Provides information on foreign sources of metals and minerals.

National Security Resources Board (NSRB)—Advises the President concerning the coordination of mobilization, including reserves of strategic and critical materials.

Council of Economic Advisers (CEA)—Advises on broad economic policies.

***Defense Production Administration (DPA)**—Directs and coordinates the defense production program including the exercise of the priorities and allocations powers, and the determination of production programs, goals and the adequacy of facilities; also issues accelerated tax amortization certificates. Directs United States participation in the International Materials Conference.

***Defense Materials Procurement Agency (DMPA)**—Purchases and makes commitments to purchase metals, minerals and other materials for government use or resale; encourages exploration, development and mining of strategic and critical minerals and metals. Makes subsidy payments. Installs equipment in facilities. Functions in accordance with programs certified by Defense Production Administration.

General Services Administration (GSA)—Purchases materials for government use or resale.

***Emergency Procurement Service (EPS)**—Purchases, inspects and stores strategic and critical materials for the national stockpile, and purchases other materials.

Department of the Interior—Responsible with the Munitions Board for stockpiling under PL 520, 79th Congress.

National Minerals Advisory Council—Advises on mineral policies.

***Defense Minerals Exploration Administration (DMEA)**—Encourages exploration for metals and minerals within the United States.

U. S. Bureau of Mines (USBM)—Maintains industry statistics. Does extensive research and development in the field of mining and metallurgy. Administers mine safety laws.

U. S. Geologic Survey (USGS)—Does geologic work of all types.

***Defense Electric Power Administration (DEPA)**—Assists in providing electric power.

Department of Defense

Joint Chiefs of Staff (JCS)—Advises as to the accessibility in time of emergency to foreign sources of strategic and critical materials.

Munitions Board (MB)—Establishes stockpile programs under PL 520, 79th Congress. Also determines military requirements for strategic and critical materials.

Research and Development Board (RDB)—Reduces requirements for strategic materials in very short supply through conservation, substitution or redesign.

Department of the Army—Aids in the determination of stockpile programs under PL 520, 79th Congress, and determines military requirements for strategic and critical materials.

Department of the Navy—As above.

Department of the Air Force—As above.

Department of Commerce

Business Advisory Council—Advises on broad business policies.

***National Production Authority (NPA)**—Allocates strategic and critical materials to meet the needs of defense programs and the national economy.

Bureau of the Census—Collects industry statistics including import-export data.

Office of International Trade (OIT)—Exercises export control powers.

Maritime Administration

***National Shipping Authority (NSA)**—Provides shipping for strategic and critical materials.

Coast and Geodetic Survey (CGS)—Conducts geophysical surveys and tidewater explorations.

Industry Evaluation Board—Selects industrial facilities, and their supporting economic resources including installations and materials which are key to the defense effort.

Facilities Protection Board—Develops programs for physical protection and maintenance of the security of economic resources selected by the Industry Evaluation Board.

Reconstruction Finance Corporation (RFC)—Purchases and resells tin, operates the government tin smelter, and makes loans to stimulate industrial production, including mining.

Department of State—Advises concerning metals and minerals development programs in foreign countries. Assists in establishing U. S. stockpile programs.

Mutual Security Agency (MSA)—Develops resources of friendly countries in the interest of their security and independence, and the national interest of the United States, and to facilitate participation in the U. N. system for collective security. Promotes increased production of materials in which the United States is deficient.

Export-Import Bank of Washington (Ex-Imbank)—Provides necessary financing to facilitate mineral development programs in foreign countries.

Tariff Commission—Evaluates the effects of tariffs on the mineral industry. (*Please turn the page*)

* Indicates temporary agencies implementing the Defense Production Act of 1950. Indentation indicates subordinate agencies within a major agency.

*Economic Stabilization Agency (ESA)—Establishes general price and wage stabilization policies.

*Office of Price Stabilization (OPS)—Establishes price ceilings for metals and minerals.

Department of Labor

*Defense Manpower Administration—Assists in obtaining the necessary labor force.

Treasury Department—Establishes and implements tax programs affecting mineral properties.

Department of Justice—Enforces anti-trust laws involving segments of the mineral industry.

Department of Agriculture—Assists in establishing U. S. stockpile programs.

Commodity Credit Corporation (CCC)—Exchange when possible surplus agricultural commodities for strategic and critical metals and minerals.

*Defense Transport Administration—Assists in providing transportation for metals and minerals.

Atomic Energy Commission (AEC)—Controls and procures fissionable and source materials.

National Academy of Sciences

Minerals and Metals Advisory Board (MMAB)—Advises on technical problems in the minerals and metallurgical field.

National Advisory Committee for Aeronautics (NACA)—Tests materials, fuels, and lubricants.

National Science Foundation (NSF)—Encourages scientific activities which support security programs.

Renegotiation Board—Issues Raw Materials Exemption List which exempts certain metals and minerals from contract renegotiation.

*Small Defense Plants Administration (SDPA)—Assists small business.

General Accounting Office (GAO)—Reviews and audits all government contracts.

Major U. S. Government Committees Concerned With Metals and Minerals

ODM Committee on Production Policy (PPC)—Representatives of Defense, Interior, Commerce, Agriculture, Labor, DPA, DMPA, AEC, DTA, ESA, NSRB, and other interested agencies as required —advises Defense Mobilizer on defense production problems such as development and operation of the mobilization production base; improving the coordination and effectiveness of federal policies and programs; and proposed legislation, orders and regulations relating to production.

DPA Defense Materials Policy Committee (DMPC)—Representatives of ODM, DPA, NPA, DMPA, ESA, GSA, MSA, OPS, RFC, NSRB, State, Interior, Munitions Board, Agriculture, Budget Bureau—reviews broad policy problems affecting the supply of materials.

DPA Defense Materials Operating Committee (DMOC)—Representatives of ODM, DPA, NPA, DMPA, ESA, GSA, MSA, OPS, RFC, NSRB, State, Interior, Munitions Board, Agriculture, Budget Bureau—reviews supply-requirements data for strategic and critical materials and recommends appropriate actions to increase supplies and to channel them to essential programs.

DPA Requirements Committee—Representatives of claimant agencies with priority and allocation authority (Department of Defense, AEC, GSA, VA, Agriculture, Interior, ICC, Commerce, State, DMPA)—reviews quarterly allocations of controlled materials and establishes the broad framework of the defense production program through allocation of controlled materials.

Munitions Board Interdepartmental Stockpile Committee (ISC)—Representatives of State, DMPA, GSA, Interior, Commerce, Agriculture, MSA, DPA, Munitions Board, NSRB, AEC, RDB, Budget Bureau, Army, Navy, and Air Force—advises the Munitions Board on the quantity and quality of materials to be stockpiled, as well as on general stockpile policy.

Senate Committees

Appropriations

Armed Services

Stockpile Subcommittee

Preparedness Subcommittee

Interior and Insular Affairs

House Committees

Appropriations

Armed Services

Stockpile Subcommittee

Interior and Insular Affairs

Subcommittee on Mines and Mining

Judiciary

Subcommittee on the Study of Monopoly Power

Joint Committees

Joint Committee on Defense Production

Joint Committee on Atomic Energy

Major International Groups Concerned With Metals and Minerals

International Materials Conference (IMC)—The purpose of these committees is to consider and recommend to governments the specific action which should be taken, in the case of each commodity, in order to expand production, increase availability, conserve supplies, and assure the most effective distribution and utilization of supplies among consuming countries.

Central Group (IMC)—Representatives of U.S., Australia, Brazil, Canada, France, India, Italy, United Kingdom, Organization of American States, and Organization for European Economic Cooperation.

Copper-Zinc-Lead Committee (IMC)—Representatives of U.S., Australia, Belgium, Canada, Chile, France, Germany, Italy, Mexico, Norway, Peru, United Kingdom.

Manganese-Nickel-Cobalt Committee (IMC)—Representatives of U.S., Belgium, Brazil, Canada, Cuba, France, Germany, India, Norway, South Africa, and United Kingdom.

Sulphur Committee (IMC)—Representatives of U.S., Australia, Belgium, Brazil, Canada, France, Germany, India, Italy, Mexico, New Zealand, Norway, Switzerland, Sweden, South Africa, and United Kingdom.

Tungsten-Molybdenum Committee (IMC)—Representatives of U.S., Australia, Bolivia, Brazil, Canada, Chile, France, Germany, Japan, Portugal, Spain, Sweden, and United Kingdom.

North Atlantic Treaty Organization (NATO)—Development of combined plans including those affecting metals and minerals to implement the North Atlantic Treaty.

Organization of American States (OAS)

Organization for European Economic Cooperation (OEEC)

International Tin Study Group

* Indicates temporary agencies implementing the Defense Production Act of 1950. Indentation indicates subordinate agencies within a major agency.

MARKETS—Trends and Prices (*Continued from page 69*)

Summary of Slab Zinc Statistics

Following is a summary of the slab zinc statistics covering the operations of smelters in this country, compiled by the American Zinc Institute, tons:

	Production	Shipments: Domestic	Shipments: Export and Drawback	Shipments: Gov't Account	Shipments: Total	Stock at End
1942	929,770	733,918	151,650		885,568	68,268
1943	971,873	831,430	56,208		887,638	173,510
1944	901,332	830,334	6,988		837,322	237,520
1945	799,520	762,925	9,422	5,302	777,649	259,391
1946	759,346	714,292	66,638	62,007	842,937	175,800
1947	848,027	698,281	117,305	140,230	955,816	68,011
1948	850,105	770,396	69,910	57,598	897,904	20,848
1949	870,113	648,285	56,929	91,526	796,740	94,221
1950	910,354	849,246	18,189	128,256	995,691	8,884
1951	931,833	836,800	42,067	39,949	918,816	21,901
1952:						
Jan.	83,205	75,039	1,782	1,582	78,403	26,703
Feb.	77,296	70,928	4,882	1,638	77,448	26,551
March	85,028	79,897	5,275	403	85,575	26,004
April	83,011	72,716	9,123	3,753	85,592	23,423
May	83,797	63,701	5,425	4,950	74,076	33,144
June	77,463	35,769	7,757	3,739	47,265	63,342
July	76,930	38,714	3,146	1,493	43,353	96,919
August	78,167	72,963	4,091	1,381	78,435	96,651

Official London Prices

Consumers in the United Kingdom obtain copper, lead and zinc at prices named by the British Ministry of Metals. Delivered prices in effect as September ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	285	0	0
Fire refined, high conductivity	285	0	0
Fire refined, high grade	284	10	0
Fire refined, min. 99.7 percent	284	0	0
Fire refined, min. 99.2 percent	283	10	0
LEAD:			
Soft, foreign duty paid	131	0	0
Soft, Empire	131	0	0
English, refined	132	10	0
ZINC:			
Foreign (G.o.b.) duty paid	122	0	0
Domestic (G.o.b.) duty paid	122	0	0
Prime Western and debased	122	0	0
Refined and electrolytic	126	0	0
Minimum 99.99 percent	128	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

September 30, 1952

Aluminum ingot, 99 plus percent, lb. (effective Aug. 4)	20c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	42.47c.
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb	$2.40
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	56½c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$191 @ $193
Selenium, 99.5 percent, lb.	$3.00 @ $3.50
Silicon, minimum 97 percent, carloads, lb.	20c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 99.3 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per unit	$38.50 @ $42.50
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3 no ratio	$27.00 @ $28.00
48% Cr_2O_3 3 to 1 ratio	$44.00 @ $56.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$9.45
Mesabi bessemer	$9.20
Mesabi, non-bessemer	$9.05
Lead (Galena), 80 percent, Joplin, Mo., ton	$202.50
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.20 @ $1.22 c.i.f. U.S. ports, duty extra. Long-term contract nominal at 90c. to 95c., c.i.f. duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.00 @ $2.55
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, f.o.b. foreign ports	$52.00 @ $53.00
Domestic, scheelite, 60 percent f.o.b. mill	$65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton (a) F.o.b. port of shipment.	$92.50

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb.	$1.82 @ $1.84½
Copper Sulphate, 100 lb.	$8.95 @ $9.95

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy. 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$ 225
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si.	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$4.85
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	9.9c.
Spiegeleisen, per long ton. 19 @ 21 percent grade	$85.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$320 @ $515
Shingle fibers	$150 @ $200
Paper stock	$109 @ $137
Waste	$77
Shorts	$35 @ $70
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or shorts	$34.00 @ $63.00
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$ per short ton	$10.15 @ $10.40
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $4.50 @ $5.50
Domestic, chemical, 55to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Flourspar, f.o.b. mines, bulk, 70% effective ton	$43.00
60% effective CaF_2	$40.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth., f.o.b. Georgia or Flordia, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.30
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet, ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton Scrap $32 and up.	
Ocher, Georgia, ton, in sacks	$26.25
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Not quoted
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$54.50
Steel, f.o.b., Pittsburgh billets, net ton	$59.00
Structural shapes, 100 lb.	$3.85

WASHINGTON IMPACT

Morton A. Reichek, McGraw-Hill Washington News Bureau

See End of CMP by Second Quarter of 1953—Tough Going for Alcoa's Alaskan Venture

IT'S A GOOD BET that the Controlled Materials Plan, the backbone of the production controls mechanism, will be out of business in second quarter, 1953. The defense mobilizers affirm that supply and demand for copper and aluminum are now in balance, and that consumers will be allotted about all they want for the first quarter.

If not for the summer strike, the story would be the same for steel. When the strike began in June, most forms and shapes of steel were already in balance, and decontrol was not far off. By April, the market should revert to that condition.

The fact that we can seriously discuss decontrol when we've only reached the chronological half-way point in the national rearmament program is a magnificent commentary on U.S. industrial capacity. Since the start of the Korean War, Congress has appropriated $128-billion for military procurement and construction, of which only about $42-billion worth has been delivered or built, and about $60-billion is on order. Still to become subject to contract before 1954 is about $26-billion.

Alcoa's Alaska Project

The Aluminum Co. of America may have a tough nut to crack before it can begin building its proposed $400-million aluminum-power project in Alaska's Taiya Valley, not far from Whitehorse, Canada. In its initial phase, the project would include an aluminum reduction plant with annual capacity of 200,000 tons and an 800,-000-kw. hydroelectric plant.

Before it can do anything else, Alcoa must get Canadian approval to dam the Yukon Gorge, raise the level of five interconnected Canadian lakes, reverse part of the discharge of these lakes through a 13½ mi. tunnel beneath Chilkoot Pass, and drop the water into Alaska to generate power.

The Canadians are cool to the idea. According to a Canadian official here, Alcoa received an "unenthusiastic" reception in Ottawa when it outlined its plans early this year.

The talk in Canada is that Alcoa's proposed project would interrupt navigation on the Yukon. The river's low-water level coincides with the period of heaviest river traffic, according to this charge. Alcoa denies this. It says the water to be diverted is useless to Canada, and that for hydroelectric exploitation, the water can be dropped only into Alaskan territory.

Behind Canada's coolness is resentment at U.S. treatment of the Aluminium Co. of Canada, whose bid for a long-term government procurement deal was recently killed by a congressional committee; if not resentment as such, then maybe Alcan pressure. Besides, the Canadian Government doesn't want to go out of its way to build up U.S. competition for one of its biggest and fastest growing native industries.

Alaska's Land Laws

Alcoa has still another hurdle to clear. Congress must enact legislation permitting the company to buy 20,000 acres of land for the smelter, powerhouse, and a town site. Under Alaska's land laws, private purchases are limited to 160 acres.

There should be no hitch on this score. There's long been a clamor for more industrialization in Alaska. The Taiya project would bring it in full gear, with new jobs for 4,000 and a new community for 20,000. In an obvious dig at the mining, fishing, and forest products industries, Alcoa makes much of its claim that it would be "the first industry in Alaska to put something into the territory without taking (natural resources) out."

In May, Alcoa applied to the Defense Production Administration for (1) authority to write off 50% of the cost of building the smelter and related facilities (but excluding the hydro plant) in five years, and (2) a commitment that the U.S. Government will give Alcoa an "equitable portion" of any new aluminum stockpile business that comes up when current government procurement contracts expire.

In turn, Alcoa promised the government and domestic fabricators first crack at Taiya output. DPA has not acted yet on Alcoa's requests. The agency is not likely to do anything until Alcoa is able to buy the necessary land and get Canada's O.K. to divert the Yukon.

The Taiya project has been hanging fire since 1947. One of the factors holding it up has been the belief that it would be a security risk. Alcoa contends that Taiya would be less vulnerable to military attack than Alcan's new Kitimat project, further south on the Pacific Coast, because the proposed smelter would be located in a narrow defile surrounded by mountains. The Defense Department now also minimizes Taiya's vulnerability.

Chile's New Regime

The State Department is "cautiously optimistic" that Chile's President-Elect, Carlos Ibanez, will not carry out his election-campaign talk of nationalizing U. S.-owned copper mines.

Ibanez, who failed to win by the required outright majority, will be formally elected by the Chilean Parliament Oct. 24, and will be inaugurated Nov. 3. His campaign was keyed to a shrill anti-U. S. pitch. In addition to the mine nationalization program, his campaign aides pledged that he would abrogate Chile's Mutual Defense Pact with this country.

In recent weeks, however, Ibanez has disavowed any hostility toward the U. S. He has steered clear of the nationalization issue, and has emphasized his determination to continue Chile's friendly relations with the U. S.

State Department observers credit Ibanez's victory to his vigorous promise to curb Chile's inflation, not to his pronounced *"Yanqui"*-baiting. Inflation is a major political issue in Chile, where prices have increased 40% in one year. The previous administration made a sad showing on this account.

The State Department's optimism is shared by U. S. businessmen in Chile, who pooh-pooh the nationalization threats. They believe Chile can't afford to seize the copper mines; it needs U. S. dollars too badly and lacks native technicians to run the mines.

Of course, practicality usually takes a back seat when hot-head nationalists take charge. Ibanez, however, is believed to be both a realist and in complete control of his regime.

Notes From the Capital

The Copper World Mining Co., Los Angeles, a new outfit, has applied for a $7.3-million RFC loan to develop a property 30 mi. northeast of Baker, Calif., in San Bernardino County. A quick decision is expected on the application. The company has done relatively little development with private funds, a factor that will have much bearing on RFC's decision . . . Robert R. Rose, assistant secretary of the Interior for Mineral Resources, has resigned to run for Congress against Wyoming's Republican representative-at-large, William H. Harrison. Rose has been assistant secretary since June, 1951. A Casper, Wyo., lawyer, he is a protege of Wyoming's new-dealing Senator Joseph C. O'Mahoney, chairman of the Senate Interior and Insular Affairs Committee . . . DPA has hiked its tungsten expansion goal from 34-million lb. per year to 40-million lb. in 1954. DPA expects the bulk of the ore to come from foreign producers.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

MINE-MILL PRESIDENT John Clark (left) and Secretary-Treasurer Maurice E. Travis are among officers called before Senate Internal Security Subcommittee.

E&MJ REPORTER Joseph Gambatese (left) chatting with Herman Clott, Mine-Mill Washington representative, at convention sessions in New York City.

Mine-Mill Holds Convention—Faces Senate Investigation

A FEW DAYS at the 48th convention of Mine, Mill and Smelter Workers in New York City last month left one with this impression:

Mine-Mill is more communist than ever. The Commies have strengthened their hold on this union claiming 100,000 members, now that the right-wing opposition has pulled out. The 250 delegates, most of them obviously not Communists or even sympathizers, followed blindly the Communist Party line laid down by Mine-Mill leaders. The union, fighting desperately, has survived the CIO raids in good shape. Now it is worried what Congress might do.

Only daily newspaper covering the sessions was the *Daily Worker*. Big, black headlines attested to the *Daily Worker's* approval of convention actions. Guest speakers were well-known left-wingers. The Civil Rights Congress, which put up bail for the Communist leaders convicted of teaching overthrow of our government, honored Mine-Mill with a plaque for aid to negro workers.

On Korea, the convention urged the communist line—a speedy truce and negotiated peace with Russia and China. (The left-wing United Electrical Workers did the same a week later.)

On Politics, Mine-Mill—again like UE—rejected both the Democratic and Republican candidates for president, favoring independent political action. Members were urged to back any friendly candidate for Congress. (Mine-Mill leaders would have liked to endorse the Progressive Party candidate, Vincent Hallinan, for president—as they did Henry Wallace in 1948, but they were afraid of rank-and-file reaction.)

Convention highlight was adoption of a 61-page "Program for Peaceful Production" labeled: "A World At Peace." Admitted Communist sympathizer Maurice E. Travis, secretary-treasurer, denied to delegates that it was communist propaganda.

The program urges breaking up what the union called U. S. monopoly of nonferrous metals, expanding world trade, and engaging in a broad socialistic program at home. The latter would include a $3 weekly family allowance from the government for each child, a 30-hour week and socialized medicine, to mention a few items.

Sen. McCarran was condemned as an agent of the mining industry to break up Mine-Mill. The delegates pledged defense of the Mine-Mill leaders under subpoena to testify Oct. 7 and 8 at hearings of McCarran's Internal Security Subcommittee at Salt Lake City, Utah.

Mine-Mill, pledging a wider organizing drive, boasted that the 10¢ settlement in copper mining has put the union ahead of others in the postwar parade of wage increases.

Mine-Mill reported assets of $106,000, a rise of $15,000. Next year's convention will be at Denver.

Salt Lake City Hearing

Union leaders formerly connected with Mine, Mill and Smelter Workers were scheduled to testify at Salt Lake City, Oct. 7-9 at the McCarran Internal Security Subcommittee investigation of this left-wing union.

Subpoenaed as witnesses friendly to the committee's objective were former Mine-Mill vice president, Homer Wilson of Mascot, Tenn., and Ralph Rasmussen of Salt Lake City; Angelo Verdu of Salt Lake City, former Mine-Mill executive board member now working for the CIO Steel Workers; Kenneth Eckert of Toledo, former Communist and former Mine-Mill board member now active in the CIO Auto Workers; and Leonard Douglas of Joplin, Mo., another former board member.

Other "friendly" witnesses include Stanley H. Ruttenberg, research director of the CIO, and J. B. Matthews, newspaper writer. Ruttenberg in 1949 prepared the CIO expulsion case against Mine-Mill, documenting the charges of following the Communist Party line on which the CIO acted.

Present Mine-Mill officials "hostile" to the investigation also have been summoned by the committee. They are John Clark, president; Maurice E. Travis, secretary-treasurer; Orville Larson, vice president; Al Skinner, regional director of Salt Lake City; and Graham ("Cozy") Dolan, special assignment aide to Mine-Mill officers.

The Reader AUDITED PAID ABC CIRCULATION *His Mark*

THE ABC SYMBOL which is printed at the head of this page is, in a very real sense, *your* brand on this magazine. Those letters stand for Audit Bureau of Circulations. The symbol indicates that the magazine is a member and supporter of that Bureau.

To the advertiser who contemplates using the magazine as an advertising medium, this symbol has a well-recognized significance. It tells him that the circulation records and practices of the magazine are wide open to the auditors of the Bureau, who check the publisher's claims and make public the precise terms and conditions under which subscriptions are obtained. And it assures him that the magazine stays in business by virtue of a demonstrated demand from its readers as shown by their paid subscriptions or newsstand purchases.

BUT HERE we are concerned only with the significance of ABC to you as a reader. For when the advertisers, the advertising agencies, and the publishers founded the Bureau nearly forty years ago to help establish honest circulation figures, they unwittingly set up a cooperative institution that has become a major safeguard for the interests of the reading public.

That is because membership in ABC constitutes one of the strongest guarantees that any publication can offer of its primary devotion to the interests of its readers. And by making that guarantee possible, ABC becomes a major safeguard of the freedom of the press, an objective of exceptional importance in these days when the public is flooded with propaganda from so many sources.

THE SUREST MEANS by which to preserve a free press is to keep it directly answerable to the reading public it would serve. It follows, then, that the survival of a truly free press must depend on its acceptance by that public; and that means in turn that the people must have in their hands some adequate means for holding the publishers responsible to them.

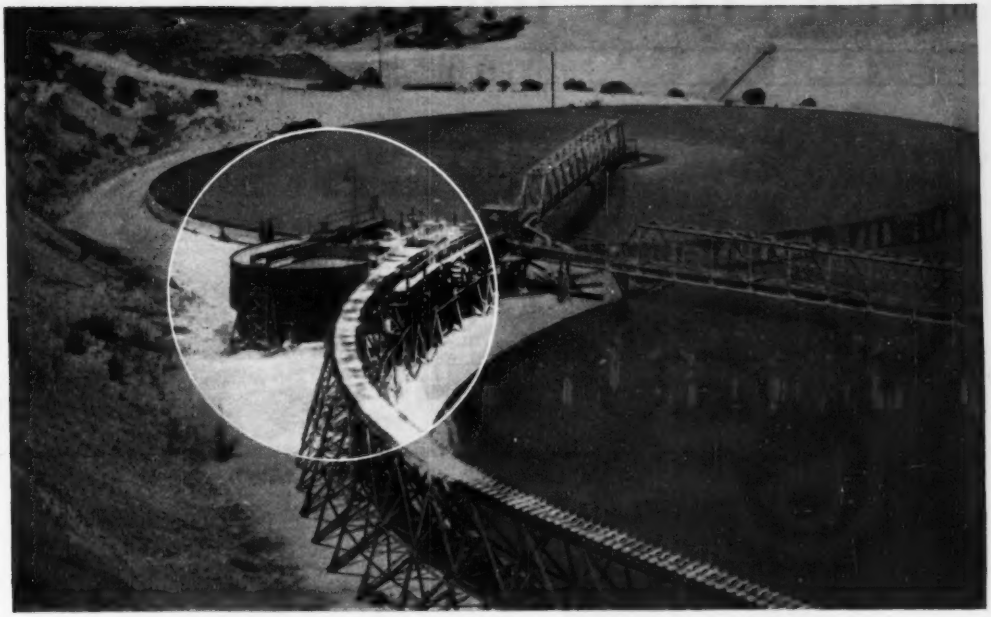
No one has yet devised any means to that end more simple, more direct or more practical than the paid subscription or newsstand purchase price. The right to purchase or refrain from purchasing a publication gives to the readers and to no one else the power to pass judgment on whether that publication should continue to serve the reading public.

TO SUPERVISE this vital process, to check and certify the integrity of the publication's circulation methods and claims, requires a strict and continuing audit of each publication's success in meeting this test of its public acceptance. To that essential function the ABC has contributed mightily by the conscientious performance of its mission. And that is why we are able to have a press supported, for the most part, by advertising revenues, but not controlled as to its circulation or content by any influence other than its readers.

When an advertiser consults the ABC statement of a publication to ascertain the amount, the quality and the trend of its circulation, he does so in the legitimate pursuit of his own interest. But at the same time, inevitably, he is helping the ABC to keep the press responsible and responsive to the reading public. For, in effect, he is asking the publication to demonstrate through its circulation figures that it owes its standing to a voluntary demand by its readers.

SO THE Audit Bureau of Circulations, by auditing and certifying paid circulations, has come to perform a vital service to the readers of this magazine and of every other member publication. And in performing that service, it helps to maintain in our country a press that is answerable to the reading public and to it alone. So long as the practices and principles for which ABC stands continue to prevail in American publishing, we shall find in it a sure support for a truly free press, responsible only to the public it serves.

McGraw-Hill Publishing Company



Smooth out your tailings operations

in spite of increased tonnage . . . changing ore characteristics

Here is how one operator solved the problem of increased tonnage and changing ore characteristics . . . with a Dorr Hydroseparator.

To handle a total of 12,000 tpd of copper flotation tailings at 26% solids, the initial installation included two Dorr Torq* Thickeners, each 225 ft. dia. When variables in ore characteristics reduced thickener capacity and increased water loss in the underflow, a Dorr Hydroseparator was installed ahead of the thickeners to compensate for shock loads. The Hydroseparator installation, resulting in better thickener performance, did two things:

1. Mill output *increased* by an average of 1,000 tons per working day.
2. The amount of water lost in thickener underflow *decreased* by 166 gpm.

The Summary of Operating Data shown here gives additional information, before and after the installation of the Dorr Hydroseparator.

To solve your tailings thickening problems, make use of our diversified experience in the field of metallurgical production. Let us know about your problems and we will work to solve them with you. THE DORR COMPANY, Barry Place, Stamford, Conn.

Dorr Hydroseparator
Summary of Operating Data
Castle Dome Copper Co., Miami, Arizona

Year	Feed to System Avg. Tons Per Day	Character of Feed	Percent Solids Combined Underflow
	WITHOUT HYDROSEPARATOR		
1948 (Jan.-June)	10,406	Hard Ore	44.5
Dorr Hydroseparator Installed July 1948			
	WITH HYDROSEPARATOR		
1948 (Aug.-Dec.)	11,436	Hard Ore	45.2
1949	11,814	Variable Ore	46.4
1950	11,905	Variable Ore	47.8
1951	12,076	Variable Ore	47.9

*Reg. U.S. Pat. Off.

Better tools TODAY to meet tomorrow's demand

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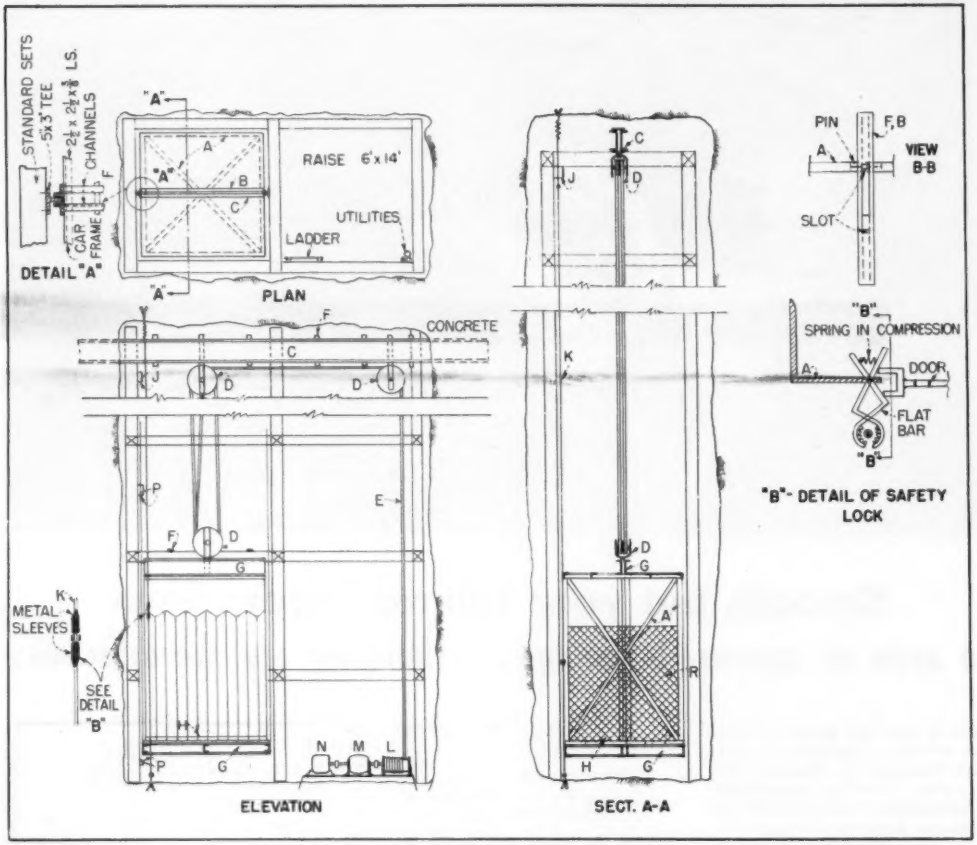
OPERATING IDEAS



Bill of Materials

A. 2x2x¼-in. frame bolted.
B. ¼-in. plate.
C. 12-in. channel, 30 lb., back to back.
D. Double sheave block.
E. Hoist cable.
F. 1x¼-in. flat bar.
G. 8-in. channel, 18.75 lb., back to back welded to guide angles.
H. 3-in. plank bolted to channel.
J. Starting switch.
K. Starting cable.
L. Hoist.
M. Speed reducer.
N. Motor.
O. Concrete foundation.
P. Limit switch.
R. Expanded metal sides.

Proposed Design for Mine Elevator

IN JANUARY, *E&MJ* published a request for proposed designs of an elevator suitable for use in raises and stopes to cut down time and effort expended by crews and supervisors in climbing. Here is the first response, a design submitted by J. W. Downey of Watsonville, Calif. Details and bill of material are shown above.

Operation. When the folding door is closed, a safety catch around the starting cable is released, allowing the cable to be pulled from the inside or outside of the cage. Limit switches placed at proper places stop the car or reverse the motion of the motor when necessary.

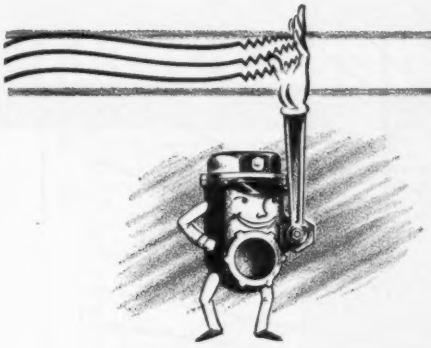
Cost. Using second-hand material, the elevator should be installed for about $3,500. Size of ladderway compartment can be reduced. A counter weight in the ladder compartment would cut down the power cost.

Any More Ideas?

If you have any further ideas on how to design an economical mine elevator to cut down ladder climbing, please send them in to Operating Ideas, c/o *E&MJ* 330 West 42nd St., New York 36, N. Y.

Specify this Fast-action Gate for quick, sure STOP and GO services

JENKINS



BRONZE GATE VALVE

125 lbs. Steam
200 lbs. O.W.G.
¼" to 2"

Wherever full, free flow is essential . . . where valve opening and closing must be instantaneous . . . Jenkins SWINGTITE Fast-Action Bronze Gate Valves are setting new standards of performance and endurance.

The exclusive rolling disc and guide track design in the new Jenkins SWINGTITE distributes the wear, assuring maximum tightness (since it prevents uneven wear of seating surfaces), and lengthens valve life.

Use the SWINGTITE wherever fast-action valves take a beating on your processing lines. Compare it for long life and low maintenance. Prove for yourself that day after day it opens freely for full flow, and, closed, it seats tight and *stays* tight.

Ask your Jenkins Distributor for the folder, Form No. 196, describing the SWINGTITE in detail. Or write: Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS

SETTING NEW RECORDS FOR LONG LIFE AND LOW MAINTENANCE IN

- Oil refineries
- Textile finishing plants
- Chemical and food plants
- Pulp and paper mills
- Mines and mineral refining

AND IN SUCH APPARATUS AS

- Laundry machinery
- Dish-washing equipment
- Gasoline and fuel oil lines on motors, burners, etc.
- Fire extinguishing steam lines

ONLY THE SWINGTITE HAS IT—

ROLLER ACTION

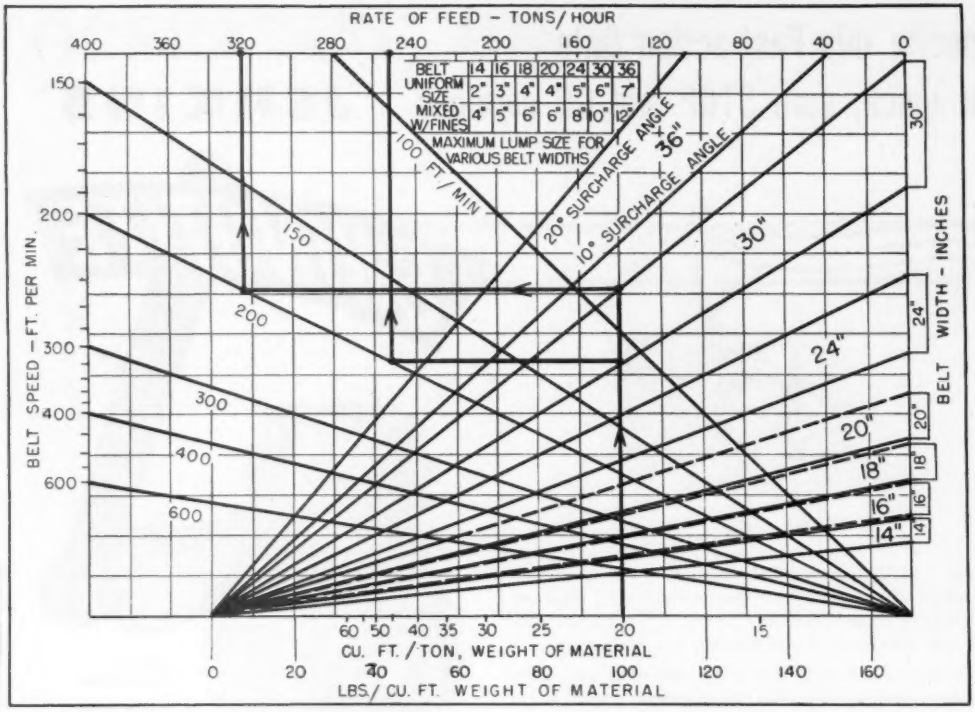
As the valve is opened or closed, guide rims (A) around the seating surfaces of discs roll freely over guide tracks (B) cast in the body, distributing wear evenly, dislodging foreign matter, and providing a polishing action for seating surfaces. This rolling disc and track construction lengthens valve life and assures maximum tightness.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros


RATE OF FEED – TONS/HOUR
400 360 320 280 240 200 160 120 80 40 0
BELT SPEED – FT. PER MIN.
150 200 300 400 600
BELT WIDTH – INCHES
BELT 14 16 18 20 24 30 36
UNIFORM SIZE 2" 3" 4" 4" 5" 6" 7"
MIXED W/FINES 4" 5" 6" 6" 8" 10" 12"
MAXIMUM LUMP SIZE FOR VARIOUS BELT WIDTHS
100 FT./MIN
150
200
300
400
600
20° SURCHARGE ANGLE
10° SURCHARGE ANGLE
36"
30"
24"
20"
18"
16"
14"
60 50 40 35 30 25 20 15
CU. FT./TON, WEIGHT OF MATERIAL
0 20 40 60 80 100 120 140 160
LBS/CU. FT. WEIGHT OF MATERIAL

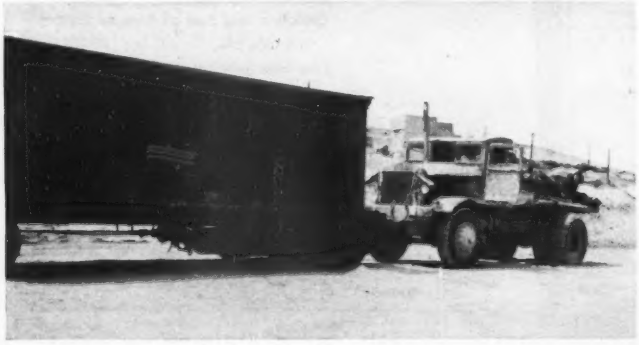
EXAMPLE: What tonnage would a 30-in belt deliver traveling at 200 fpm if the material weighed 100 lb. per cu. ft. (20 cu. ft. per ton)?

ANSWER: For a surcharge angle of 10 deg., 252 tons per hour. For a surcharge angle of 20 deg., a 30-in. belt would deliver 324 tons per hour.

Chart Simplifies Selection of Conveyor Belt

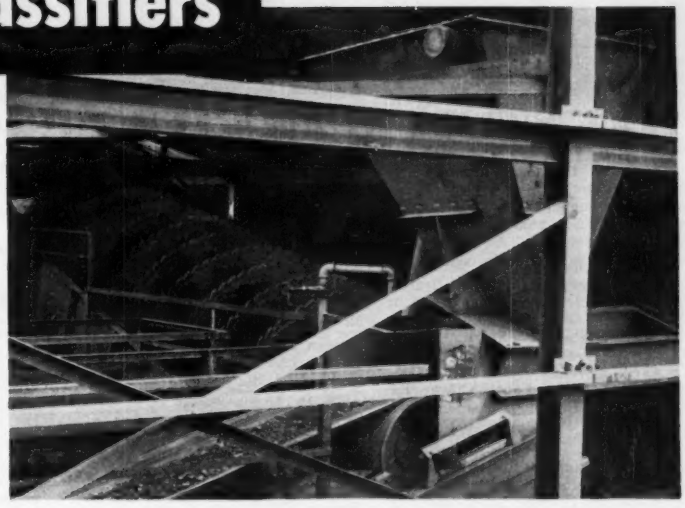
C. W. MATTHEWS of O. W. Walvoord Co., Negaunee, Mich., submits this handy conveyer belt selection chart. It is a composite of information contained in the "Goodyear Book of Belting" and Hetzel and Albright's "Belt Conveyors and Belt Elevators," Table 8-b, p. 197, published by John Wiley & Sons Co., Inc. Given any combination of known information such as belt speed, rate of feed, weight of material, surcharge angle, width of belt, it is possible to determine an unknown quanity quickly. See example above. Also note the table of maximum lump size for various belt widths at the top of the chart.

Heavy Truck Replaces Switch Engine



ISBELL CONSTRUCTION CO., of Reno, Nev. removing copper ore from the Morris pit of Consolidated Coppermines Corp., Kimberly, Nev. under contract at the rate of 5,000 tons a day is using the old 15 ton Euclid diesel truck shown for spotting cars at the truck-dump siding. To serve in place of a switch engine, the truck was stripped of its end-dump body and the front end of the chassis fitted with a standard railroad car coupling. The truck carrying a heavy load of steel ballast can move a string of fifteen 70 or 85-ton ore cars.

Now, 84" Simplex and Duplex Akins Classifiers



84" Akins Separator Installation on the Iron Range

DESIGNED FOR CLOSED CIRCUIT WITH BIG CAPACITY BALL MILLS

The 84" Akins is the largest classifier available, and *it will close circuit ball mills as large as 12' in diameter without any additional equipment.* Some of the advantages of the large grinding circuit, compared with two smaller ones, are:

- **Lower initial equipment cost.**
- **Lower maintenance costs.**
- **Less space required.**

This big capacity 84" Akins was made possible by design of an improved, more compact stub bearing and new lifting device.

COLORADO IRON WORKS CO.

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PERSONAL NEWS

Franklin Gray Pardee, Michigan state geologist, Lansing, has been appointed president of the Lake Superior Iron Ore Association, succeeding the late M. D. Harbaugh.

Alvin S. Cohan, associate editor, has been appointed editor of the Journal of Metals, New York, N. Y.

James A. Rabbitt, consulting engineer and an authority on Japan and the Far East, has retired from active service after 22 years with The International Nickel Co., Inc., New York, N. Y. He will continue in an advisory capacity on Far Eastern affairs.

C. V. O. Hughes, formerly with Great Lakes Carbon Co., is now assistant manager of the Florida department of Virginia-Carolina Chemical Corp. in Nichols.

Nancy H. Compton has joined the New York Technical Services Branch of the Atomic Energy Commission; **Leonard D. Jarrard** is chief, Butte Sub-office of the AEC, Salt Lake City, Utah; and **Charles R. Maise, Robert L. Akright, William A. Carlson, Robert C. Gerhard**, and **Joseph O. Carter** are now at Grand Junction. All are geologists.

Dr. Carl R. Freberg has been appointed assistant director of the Borg-Warner Research Laboratory in Bellwood, Ill. Dr. Freberg previously was head of the Equipment Research Department of the Naval Civil Engineering Research and Evaluation Laboratory at Port Hueneme, Calif.

Roger M. Blough, New York, N. Y., vice chairman of the board, has been elected a director of United States Steel Corp. and a member of its finance committee. Mr. Blough was formerly executive vice president—law and secretary and a director of United States Steel Co.

Leslie M. Case of Orange, Tex., has been appointed director of the Mining Machinery Division in the Industrial and Agricultural Equipment Bureau, National Production Authority. Mr. Case, formerly deputy director, succeeds **Harold Montag**, who is returning to the executive staff of Joy Manufacturing Co., Pittsburgh, Pa.

Horace C. Young has been appointed chief mining engineer and director of the mining division of the Newfoundland and Labrador Corp., Ltd., St. John's, Newfoundland.

Hugh Sutherland Lewis, vice president of operations, has been appointed executive vice president of Michigan Limestone Division, U. S. Steel Co., Detroit, Mich.

Clarence O. Mittendorf, acting head of the Defense Minerals Exploration Administration, has been named administrator.

Harvey J. Hakala, who left Duluth, Minn. to become president of U. S. Steel's Brazilian subsidiary, Cia Meridinoal de Mineracao, has returned to the mining engineering department of Oliver Iron Mining Division in Duluth.

O. N. Friendly, vice president and consultant and former general manager, Park Utah Consolidated Mines Co., Salt Lake City, Utah, retired Sept. 1 after 43 years of activity in the Park City district.

Gordon R. Wynne has been appointed assistant superintendent of the Extaca plant of the Oliver Iron Mining Division at Virginia, Minn.

E. W. Geist, in charge of M. A. Hanna Co.'s Groveland pilot plant at Randville, Mich., has returned to the company's research laboratory at Hibbing, Minn.

A. J. Sullivan, Minnesota chief clerk at M. A. Hanna Co. mines since 1917, has retired.

Dean R. Gridley has been appointed vice president in charge of sales for the United States Potash Co., New York, N. Y., succeeding **J. E. Barnes**, retired.

Lawrence Litchfield, Jr., president, has announced the closing of Alcoa Mining Co.'s New York offices and the move to Alcoa Building, 425 Sixth Avenue, Pittsburgh 19, Pa.

J. S. Roper has been promoted to mine superintendent at Howe Sound Exploration Co., Ltd., Snow Lake, Manitoba.

Arthur S. Hotchkiss, who instituted the widely copied employee training program of Tennessee Coal & Iron Division of U. S. Steel Co., has retired after 32 years of service.

Hollis G. Peacock has returned to the employ of United States Smelting Refining and Mining Co. with headquarters at Salt Lake City, Utah. Mr. Peacock will transfer to Boston, Mass. at the first of the year, succeeding L. F. Paddison, retiring.

Dr. Eugene S. Perry, Butte, Mont., for over 25 years head of the department of geology of the Montana School of Mines and chief geologist of the Montana Bureau of Mines & Geology, has retired. Dr. Perry is moving to Columbia, S. C. to accept a staff appointment with the University of South Carolina.

James Y. Murdoch has been appointed vice president of Wright-Hargreaves Mines, Ltd., Kirkland Lake, Ont., succeeding the late **George McCullagh**.

Thomas L. Kesler has been appointed senior geologist of the Tennessee Coal & Iron Division of United States Steel Corp., with headquarters in Jefferson City, Tenn.

Robert S. Douglas, former manager of Canadian Exploration, Ltd., Salmo, B. C., has been appointed general manager of Western Uranium Cobalt Mines, Ltd., British Columbia.

Edward A. Nanton has been named president of the Calgary & Edmonton Corp., Ltd., Alberta, succeeding the late **Col. L. D. M. Baxter. John F. Merriam** and **Gordon P. Osler** were elected directors.

Joseph C. Kieffer, Kellogg, Idaho, has joined American Smelting & Refining Co. as assistant manager of the firm's operations in the Couer d'Alene mining district in northern Idaho, with headquarters in Wallace.

Ira A. Wyant has accepted a position with Shell Oil Co. as geological engineer at Long Beach, Calif.

OBITUARIES

Henry Morris Hartmann, 64, died in Salt Lake City, Utah, on Aug. 17. Mr. Hartmann served as private mining consultant and manager for International Smelting & Refining Co. and on the Non-Ferrous Metals Commission, War Labor Board.

David S. Tait, 73, former president of Privateer Mines Ltd. and senior partner in the law firm of Tait and Marchant, died Aug. 12 at Vancouver.

Jack W. Clark, head of Jack W. Clark Associates and geological and mineralogical consultant for The Beryllium Corp., passed away on Aug. 8 in Tenanarive, Madagascar, while on an exploration assignment.

C. W. G. Dowsett, 77, passed away in Toronto. An outstanding gold metallurgist of South Africa and Canada, he was the originator of the Dowsett colorimeter test for determining the minute quantities of gold in apparently barren solutions.

Hugh J. Fraser, 55, of New York, N. Y., died at St. Mary's Hospital, Montreal, on Aug. 22. Mr. Fraser, a graduate of Queen's University at Kingston, Ont., was vice president in general charge of all plant operations in the United States of The International Nickel Co., Inc., and assistant vice president of The International Nickel Company of Canada, Ltd.

Dr. Poole Maynard, 69, one of the nation's most prominent geologists, died Aug. 22 in Macon, Ga. Dr. Maynard, former assistant state geologist for Georgia, received his doctorate from John Hopkins University. He was consulting geologist for the Atlantic Coast Line Railroad Co. and adviser in nonmetallics to the U. S. Bureau of Mines.

EUCALYPTUS FORESTER

DEEP-SEA SKIPPER

DIAMOND DRILL EXPLORER

E&MJ Calls On Dr. Ernesto Romagosa

PERHAPS NO MAN DESERVES the title of "Mr. Mining of Cuba" more than Dr. E. Romagosa, president of Minas de Matahambre, because of his boundless faith in a great mining future for the Republic. In fact, Matahambre today owes its very existence to the faith, perseverance, and optimism of Dr. Romagosa and his staff associates who in 1944 refused to abandon operations when the great mine ran out of ore. In that year they drove the proverbial "extra round" to expose a bonanza—the famous 44 Orebody, from which Matahambre still yields approximately 1,000 tons of rich copper-bearing ore daily.

This production provides a livelihood for some 1,100 men on the payroll, and indirectly supports 6,000 to 7,000 people in the area. The community includes several government schools in addition to a private school, a well-staffed hospital, golf course, country club, numerous modern staff houses, a clubhouse, and an inviting church with altar, furniture, and structural members beautifully carved and fashioned by the mine craftsmen in the timber and woodworking shops. Matahambre is reforesting hundreds of surrounding acres with tens-of-thousands of eucalyptus seedlings to assure future timber supplies for the mine and region. Many miles of good access roads have been built by Matahambre to develop the mineral possibilities of the area. All of this prosperity stems from a firm conviction that more ore was in the ground in 1944.

A very brief sketch of Dr. Romagosa's career would run about like this: He was trained as a dentist and soon established himself successfully in that profession. In 1917 he was married to the daughter of Don Manuel Luciano Diaz. Later he developed a consuming interest in geology and mining, and terminated his dental career to become a director of Minas de Matahambre in the 20's, at which time the property was run by American Metal Co. In 1944 he became president of Matahambre.

In addition to guiding Matahambre to continued production, Dr. Romagosa finds time to look for more ore elsewhere. He is president of Compania Inspiracion Cubana de Cobre, S.A. which is developing the San Fernando mine in the Province of Las Villas, and is keenly interested in other promising mining prospects in Cuba.

He is a man of vision. To him a tiny speck of sulphide seen through his mineral lens may grow and grow until it becomes a producing mine. His enthusiasm, however, is tempered by the opinions of the finest geophysicists, geologists, and consulting engineers he can engage. On a grander scale, he might with a sweep of his hand indicate a group of fire-red, gossan-capped hills and say, "That's real mining country!"—and when he does you know he is thinking of more Matahambres.

A quick glance at the informal shots of the doctor shown here will convince you that he's man of many interests. During his energetic career it hasn't been at all unusual for him to go on rugged camping trips by horseback to pan for gold or beat up likely looking outcrops with his prospector's pick. He is also a gracious host, husband, and father, and *E&MJ's* sincerest wish is that he finds more Matahambres in our neighbor republic, Cuba.

GRACIOUS HOST AND HUSBAND. Geo. Schaefer, mine mgr. at right.

HARD-ROCK MINER, who checks his operations thoroughly.

MAN OF VISION—"That's real mining country!"

NEW BOOKS

The Mineral Resources of the World. An atlas of the world's resources by William Van Royen, head of Department of Geography, University; Oliver Bowles, formerly chief Non-Metals Economic Branch, U. S. Bureau of Mines; in collaboration with Elmer W. Pehrson, chief Economics and Statistics Division, U. S. Bureau of Mines. Numerous mineral economics specialists have assisted the above authors in preparing this useful pictorial compilation of facts and statistics pertaining to coal, petroleum, water power, iron ore, manganese, nickel, chromite, tungsten, molybdenum, vanadium, bauxite, copper, lead, zinc, tin, mercury, gold, silver, platinum-group metals, uranium and radioactive minerals, phosphate, potash, sulphur and pyrites, salt, diamonds, asbestos, fluorspar, graphite, and mica. This volume is so well done that it should be "required reading" in economic geology classes. Approximately 125 maps are presented in this atlas covering the world and local areas of importance to the mineral industry. Published by Prentice Hall, Inc., Publishers, 70 Fifth Ave., New York 11, N. Y. Pp 181. Price $10.75.

Symposium on Mineral Dressing. The following papers presented at a symposium on mineral dressing held in London by The Institution of Mining and Metallurgy during September have been received:

No. 2. Mathematics of Crushing and Grinding by Fred C. Bond.

No. 8. Release Analysis, A New Tool for Ore Dressing Research by C. C. Dell.

No. 9. Defining the Scope of the Open Circuit Rod-Mill in Comminution by J. F. Myers.

No. 10. Recent Developments in Classification and Fluidization as Applications of the Principles of Particle Dynamics by J. V. N. Dorr and F. L. Bosqui.

No. 11. Crushing and Screening in Mineral Dressing Plants by G. J. Brown.

No. 12. Recent Developments in Gravity Concentration by F. B. Michell.

No. 14. Recent Developments in Plant Design for Dense Medium Processes by F. J. Trotter.

No. 15. The Heavy-Media Plant at Stripa Mine, Sweden by S. Dalhammar and R. H:Son Fahlström.

No. 17. A Study of the Motion of Solid Particles in a Hydraulic Cyclone by D. F. Kelsall.

No. 18. The Hydroclone, Its Application and Its Explanation by F. J. Fontein and C. Dijksman.

No. 19. Concentrating Ores by Pneumatic Tables by E. A. Knapp.

No. 21. The Surface Chemistry of Flotation by Nathaniel Arbiter.

No. 22. Selective Flotation of Metals and Minerals by J. H. Schulman and T. D. Smith.

No. 23. The Process of Bubble-Mineral Attachment by L. F. Evans and W. E. Ewers.

No. 27. The Application of Electrochemical Methods to Flotation Research by S. G. Salamy and J. C. Nixon.

No. 28. Some Aspects of the Flotation of Oxidized Minerals by E. J. Pryor.

No. 30. The Flotation of Oxidized Zinc Ores by Maurice Rey and Paul Raffinot.

No. 32. Electrostatic Separation by S. B. Hudson.

No. 35. The Treatment of Ore from the Gold Mines of Union Corporation, Ltd.; a Summary of Metallurgical Practice by O. A. E. Jackson.

No. 36. Recent Developments in Practice at the Sullivan Concentrator by H. R. Banks.

No. 39. The Preparation and Grading of Chrysotile Asbestos in Canada by G. F. Jenkins.

From the above list of titles and authors, it is clearly evident that the recent London symposium conducted by The Institution of Mining and Metallurgy provided a wealth of up-to-date and useful information to the mineral dressing industry. By way of constructive suggestion it might be added that engineers who attend various American mining conventions would get a lot more out of the meetings if they would be provided with the same kind of neatly prepared, pocket-size, pre-publication proofs of subjects to be presented. To our way of thinking, if a paper is worth giving at all, a copy of it should be in the hands of those who listen to the paper so that they can study the illustrations and take the information home for future reference.

A.K.

The Mines Register, 1952 Edition. A compilation of the latest available information on approximately 7,000 active metal and nonmetallic mines in the Western Hemisphere. The 1952 edition also lists 40,000 inactive mines and their locations. A comprehensive buyer's guide listing manufacturers of various types of equipment and supplies is listed by areas and by products. Published by Mines Register, 425 W. 25 St. New York 1, N. Y. Pp. 772. Price $25.

The following reports may be obtained from the Publications Distribution Section, Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.:

R.I. 4874. Pilot-Plant Batch Retorting of Colorado Oil Shale.

R.I. 4881. Experimental Treatment of Barite Ores from Montgomery County, Ark., and Morgan County, Mo.

R.I. 4871. Separation and Utilization Studies of Bitumens from Bituminous Sandstones of the Vernal and Sunnyside, Utah, Deposits.

R.I. 4861. Electrolytic Manganese Tests in Cooperation with Industry.

R.I. 4884. Concentration of Oxide Manganese Ores from the Vicinity of Cleveland, Bannock County, Idaho.

R.I. 4900. Recovery of Thallium from Smelter Products.

R.I. 4890. Investigation of the Millett Copper Deposit, Illiamma Lake, Southwestern Alaska.

R.I. 4879. Recent Practice at the Bureau of Mines, Boulder City, Nev., Titanium Plant.

R.I. 4869. Investigation of the Colorado Copper Co. Properties, Mesa and Montrose Counties, Colo.

The following publications may be obtained from the State of California, Department of Natural Resources, Division of Mines, Ferry Bldg., San Francisco, Calif.:

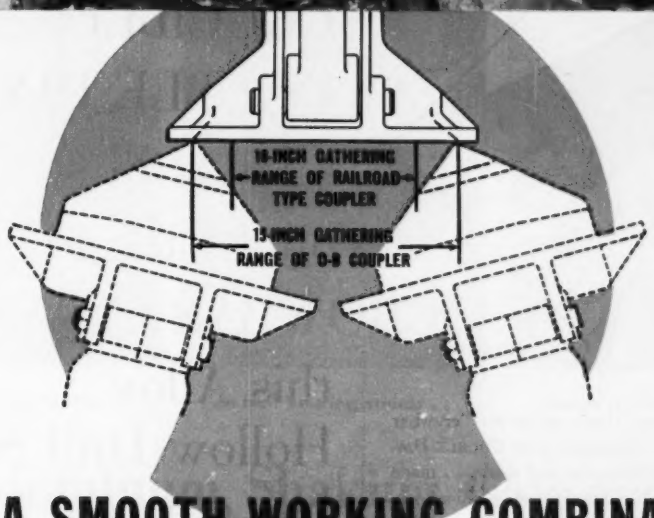
Hydraulic Filling in Metal Mines. By W. E. Lightfoot. A comprehensive study of the subject including references to mines in many parts of the world. A table is included listing 19 mine properties where hydraulic filling is now in progress. This also emphasizes the thoroughness of the author in preparing the report. Pp. 28, 15 figs. Price 50¢, in California add 3% sales tax.

Geology of Massive Sulfide Deposits at Iron Mountain, Shasta County, Calif. By A. R. Kinkel, Jr., and J. P. Albers, prepared in cooperation with the USGS. Orebodies here are composed almost entirely of sulphide minerals, and are in sharp contact with rhyolite. The orebodies range in size from a few thousand tons to more than 5-million tons, but all are faulted parts of an originally continuous orebody that was 4,500 ft. long. Pp. 19, 6 pls., 6 figs. Price 75¢.

Geology of the Saline Deposits Bristol Dry Lake, San Bernardino County, Calif. By Hoyt S. Gale, prepared in cooperation with the USGS. These deposits contain gypsum, sodium chloride, calcium chloride, and celestite. Pp. 24, 1 pl., 2 figs. Price 35¢.

Photogeologic Interpretation Using Photogrammetric Dip Calculations. By D. H. Elliott. Now they're actually determining dip of structures from the air. This report tells you how. Pp. 21, 9 figs. Price 50¢.

4288-AM



IT'S A SMOOTH-WORKING COMBINATION

when these couplers put their heads together

Acting without the guiding hands of a trip-rider or motorman, O-B Mine Car Couplers put their heads together automatically. In so doing, they speed the gathering and coupling operations in a busy haulage system, and help to get more loaded cars to the dump each shift. Even on short-radius curves, dips, or knuckles, the wide gathering range over which these O-B couplers operate makes sure that one head will guide the other as they join, and that each will make a secure connection with the other.

"Joining securely on impact" is the best description of what happens when O-B couplers put their heads together. It is also one of the best features you could want for your haulage system. When it's time to replace present couplers or replace your cars, call in an O-B representative. You will be pleased with the coupler suggestions he can make when you put your heads together!

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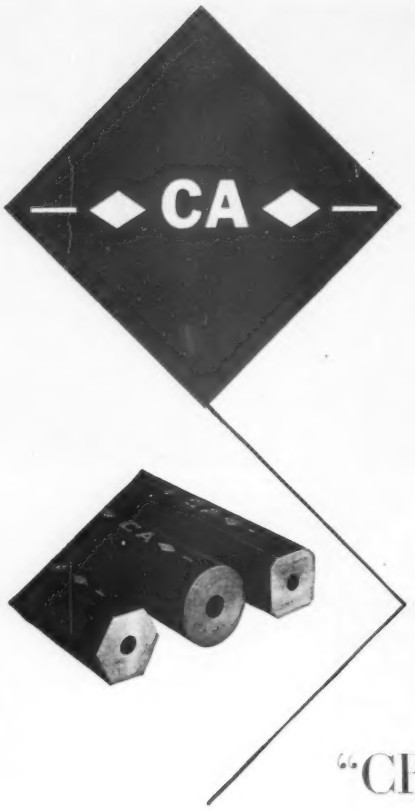
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.



NEW

CRUCIBLE DOUBLE DIAMOND takes drill steel out of the "CROWBAR CLASS"

At last! A drill steel that's not in the "crowbar class" . . . because Crucible's new DOUBLE DIAMOND hollow drill steel is a *tool* steel . . . made by drill steel specialists to tool steel specifications. Its greater fatigue strength means lower cost per foot drilled . . . and saves those *valuable carbide bits.*

Find out first hand about this step forward in drill steel — find out how Crucible DOUBLE DIAMOND in your drilling operation does a better job . . . faster! Write for full details. Do it now!

this Alloy Hollow Drill Steel has greater fatigue strength . . . cuts bit losses . . . lasts longer

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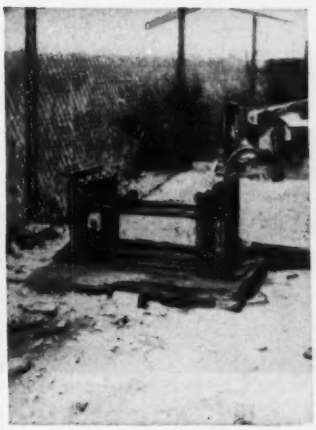
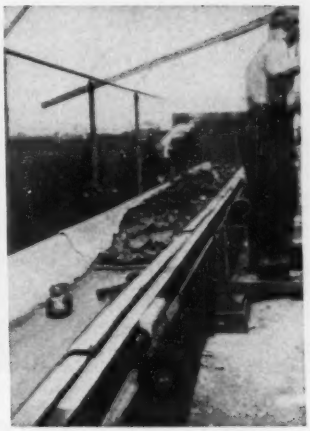
For further information on these products, circle item numbers on card—insert and mail.

FEATURE

Motion-transmitting rails . . .



on ball bearing stands . . .



shake lightweight pans.

Aluminum Shaking Conveyor Saves Weight, Moving Time (1)

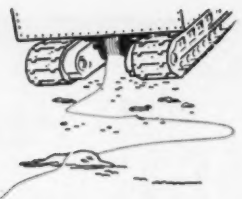
APPLYING AN ENTIRELY NEW DESIGN principle in which the shaking motion is transmitted from rails to individual, unconnected, lightweight pans, the Holzworth aluminum shaker conveyor is reported to offer important savings in weight and moving time.

Three parts making up the conveyor line are (a) the rail transmission sections, 18 ft. long, weighing 180 lb.; (b) ball bearing stands weighing less than 50 lb.; (c) 6-ft. long pans weighing about 60 lb. Pans are merely inserted, unfastened, into a cradle between the rails. In making a new setup, the pans are moved forward by the shaking motion and don't have to be manhandled. About 108 ft. of pan line can be disassembled with 12 bolts.

Total moving up time of 165 ft. of pan line is 29 minutes, according to the manufacturer. This includes four minutes for moving the pans, 24 minutes for the rail sections.

While first cost is somewhat more than orthodox shaking conveyors, pan replacements will cost less than steel pans. Pans made from Frontier 40-E aluminum alloy offer a 50% weight saving over steel.

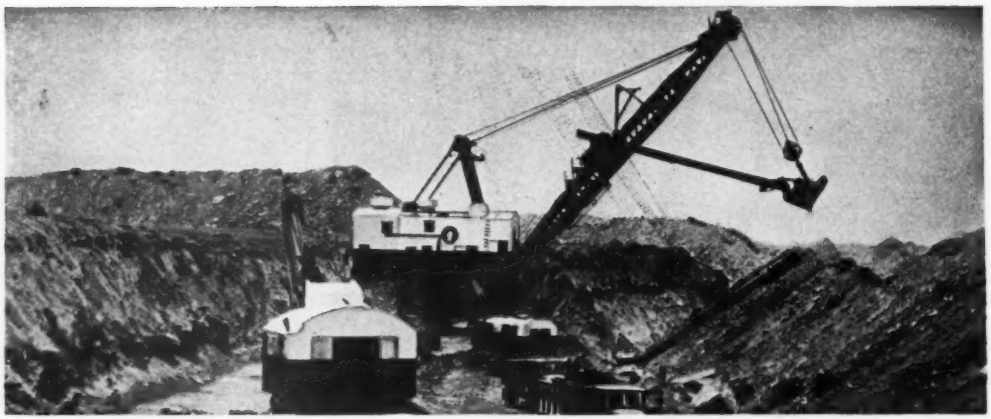
E. Harvey Holzworth, president of Frontier Bronze Corp., Niagara Falls, N. Y., is the inventor. For more information, circle No. 1 on the postage-free reply card opposite page 126, and mail as soon as possible.



proved in **our** mines

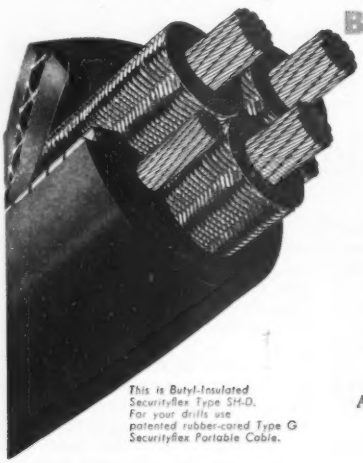
for better performance in **yours**

We—at Anaconda—are miners ourselves. We know shovel cable because we use lots of it. Safety and uninterrupted flow of power are important in any mining operation. In both respects we know Securityflex Type SH-D has a good record.*



for longer "failure-free" service on big shovels, insist on

Butyl-Insulated Securityflex above 2kv



This is Butyl-Insulated Securityflex Type SH-D. For your drills use patented rubber-cored Type G Securityflex Portable Cable.

ANACONDA Securityflex Cable is safer, less liable to "blow-out," easier to work with. Here's why:

BUTYL INSULATION. This accounts for improved resistance to moisture, ozone, heat (up to 80C).

NEOPRENE JACKET. Here is real flexibility and great strength engineered for this specific tough use. Handles well, has high impact resistance and lasts longer in all weather.

RUBBER-CORED GROUND WIRES. This safety-first feature prevents kinking, gives greater shield contact, and cushions the wires.

COPPER-COTTON SHIELD. Special new-type shield makes splicing easier, faster without damage to insulation. Eliminates chafing failures.

Ask your Anaconda Sales Office or Distributor to show you this and other ANACONDA portable mining cables. Learn how continuous improvements have made these famous cables better . . . for safety . . . and for increased production at less cost in your mine. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

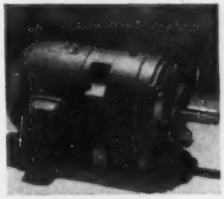
*Trademark

the right cable for the job ANACONDA® **wire and cable**

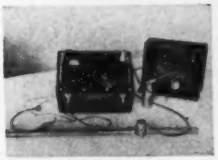
SCINTILLATION METER. Exceptional sensitivity and stability are said to feature scintillation survey meter designed for AEC by Nuclear Research Corp., Philadelphia, Pa. Meter is self-contained, portable, designed for field use. Waterproof construction permits immersion without damage. **(2)**

AIR TRANSFORMER offers finger tip control for close pressure regulation. Traps oil and moisture present in compressed air lines. Has two regulated outlets and two unregulated. Capacity is 100 cfm. Easily drained by push-pull drain knob. Manufactured by DeVilbiss Co., Toledo, Ohio. **(3)**

ACETYLENE TORCH. Pistol shaped "Torch - O - Matic" lights at squeeze of trigger, shuts off on release. Eliminates separate operation and equipment for relighting, manual adjustment, pumping or priming, and warm-up. Velocity Power Tool Co., Pittsburgh, Pa. **(4)**



GEAR MOTOR is built in three pieces to permit quick removal of defective stators without disturbing gear components. Available in speed ratings of 780 to 13.5 rpm. Comes in 1 to 75 hp. for standard applications. General Electric Co., Schenectady, N. Y. **(5)**

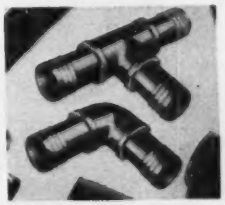


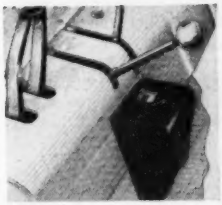
ULTRASONIC MICROMETER measures thickness by determining frequency at which resonance of high frequency sound waves occurs in material under test. Measurements consistently within 0.5% have been made. Branson Instruments Inc. **(6)**

PUMPS. Packaged line of close-coupled pumps in capacities from 5 to 150 gpm and heads from 0 to 110 ft. Off-shelf delivery of any of 29 combinations in ¾, 1¼, 1½ and 2-in. sizes, single or three-phase motor. Aurora Pump Co., Aurora, Ill. **(7)**

SPLIT WASHERS (trade-named "Sabeco") make it unnecessary to dismantle machine to intall new bearing. Just slip split washers over the shaft and lock with safety key for quick on-the-spot repair. Saginaw Bearing Co., Saginaw, Mich. **(8)**

PLASTIC PIPE FITTINGS. Carlon Products Corp., Cleveland, Ohio, has developed insert type ell and tee couplings to facilitate sharp turns or take-offs. One fitting makes connection that used to take three or four. Uses stainless steel clamps. **(9)**



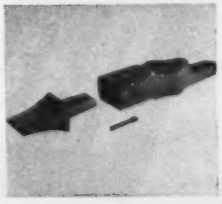


BATTERY CHARGE INDICATOR can be mounted so that truck operator can see the dial at all times, thus getting instantaneous readings of the state of battery charge while truck is operating. Gould National Batteries, Inc., Trenton, N. J. **(10)**

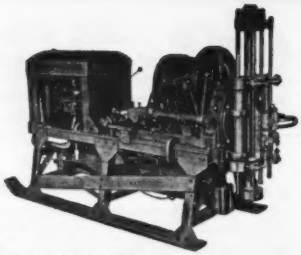
VALVE SHIELD. Flexible valve shield made of neoprene synthetic rubber fits over valve and protects operator from injury if valve stem packing should fail particularly where handling acid. E. I. du Pont de Nemours & Co., Wilmington, Del. **(11)**

TAPE is made of Ni-Clad steel with figures and graduations an integral part of the steel. Features "instantaneous" markings (last preceding foot number repeated each inch). Prices: 25 ft., $3.50; 50 ft., $4.50; 100 ft., $6.50. Lufkin Rule Co. **(12)**

CLAMSHELL TOOTH. Reversible and replaceable cutter supplants one-piece tooth. Base is permanently attached to lip in the usual manner and reversible tip fits into slot and wedges itself into base. Blaw-Knox Co., Pittsburgh, Pa. **(13)**



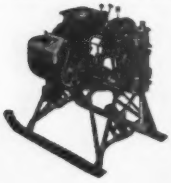
BBS-2: Versatile, choice of 5 swivelheads. Depth to 2400 ft. Gas or diesel.



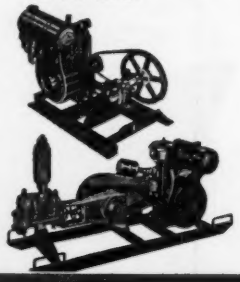
BBS-4: Drills to 5000 ft. with "B" rods. Moves under own power. Gas or diesel.

X-RAY: Compact, portable—185 lbs. net. Drills ¾" core to 200 ft. Low fuel consumption.

BBS-1: World's best known surface drill. Takes "E" rods to 1000 ft., "A" to 800 ft.

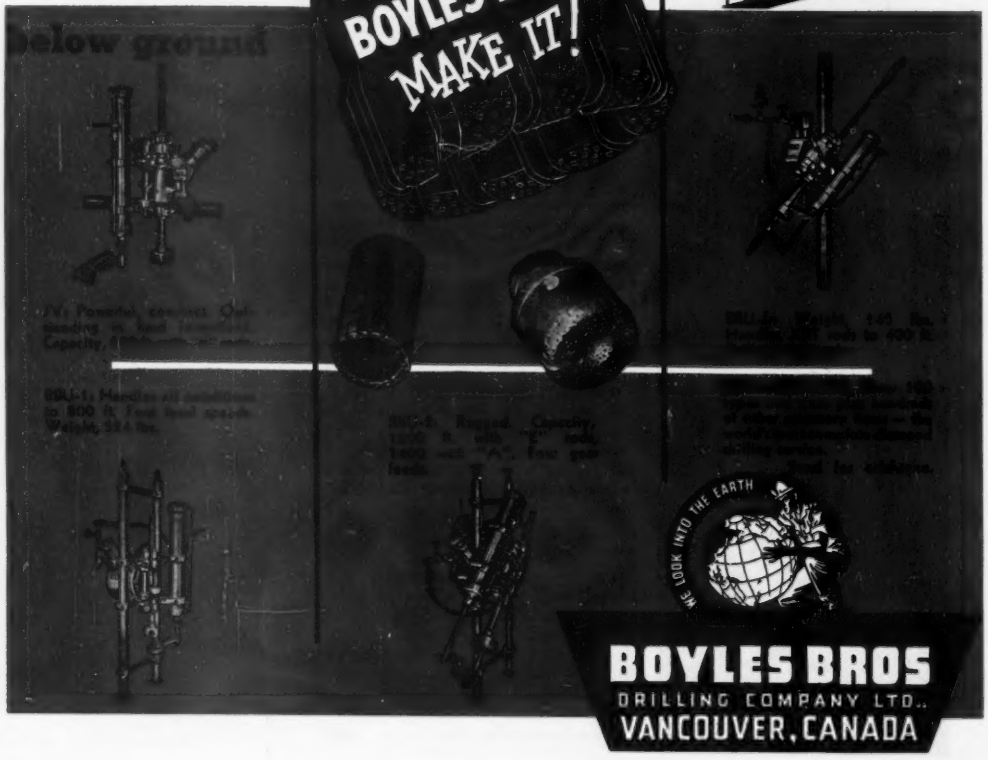


5-12 and 4-7 Drill Pumps with capacities 400 to 1200 g.p.h. Also 360 model—ideal to 2000 ft. radius.



If it's for diamond drilling BOYLES BROS MAKE IT!

above ground



WE LOOK INTO THE EARTH

BOYLES BROS

DRILLING COMPANY LTD.,

VANCOUVER, CANADA

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

FLEXIBLE TUBING. What kind, where and how to use "Spiratube" and "Flexflyte" flexible tubing, is concisely covered in a four-page catalog C2-3, offered by Flexible Tubing Corp., Guilford, Conn. (41)

DERMATITIS CONTROL. Pointing out that skin diseases annually cost industry $100-million, West Disinfecting Co., Long Island City, N. Y., has published a comprehensive 32-page booklet, "The Control of Dermatitis in Industry." In addition to discussing the company's line of soaps, protective creams, and garments, a check chart on skin diseases plus preventive measures for different types of dermatitis, makes this a good item for all safety men. (42)

SCRAPER. The 15½-cu.-yd. scraper made by Euclid Road Machinery Co., Cleveland, Ohio, hauls heaped loads up to 21 cu. yd. at a top speed of 28.2 mph. Specifications and design features are described and illustrated in an eight-page catalog. (43)

SCREEN HEATER. The Hanco electric screen heater makes screen cloth changes as simple as they are on unheated screens and a bulletin by the manufacturer, F. R. Hannon & Sons, Canton, Ohio, tells you all about it. (44)

IMPROVED FLOTATION RECOVERY. How conditioning efficiency increases flotation recovery is the subject of a bulletin released by Denver Equipment Co., Denver, Colo. Bulletin states the case for the Denver Super-Agitator and Conditioner. (45)

SULPHUR MILLING. The crushing and concentrating of low grade (25%) sulphur deposits gets complete coverage in Bulletin No. M4-B61 from Denver Equipment Co., Denver, Colo. (46)

FEEDERS AND CONVEYORS. A comprehensive booklet, well illustrated with diagrams and photographs, Catalog 830 is packed with information about Jeffrey-Traylor electric vibrating feeders and conveyors made by Jeffrey Mfg. Co., Columbus, Ohio. (47)

VIBRATING CONVEYORS. Jeffrey Mfg. Co. takes up the subject of mechanical vibrating conveyors in Catalog 849. (48)

FLEXIBLE COUPLINGS. Plentiful engineering data on flexible couplings is grouped and conveniently indexed in Catalog No. 51 from Thomas Flexible Coupling Co., Warren, Pa. If you want this comprehensive book (and you should, if you are concerned with power transmission), write to Thomas on your company letterhead.

STORAGE BATTERIES. Some good arguments for the use of Nickel-Iron-Alkaline storage batteries in your mine locomotives and shuttle cars, are registered in this 12-page brochure from Edison Storage Battery Division, West Orange, N. J. (49)

CALCULATING PUNCH. This may sound like a revised edition of "The Manly Art of Self Defense," but it's really the newest of the punched-card accounting machines available from Remington Rand, Inc., New York, N. Y. Flexible and versatile, its applications include sales control, billing, payroll, labor distribution, production, and material accounting. Booklet #TH809 gives the details. (50)

CONVEYOR BELTING. Major causes of belt failures and how Barber-Greene Co. (Aurora, Ill.) belts combat them, plus useful pointers and tables for belt selection, feature this eight-page bulletin. (51)

OSCILLATING CONVEYORS. Positive action Flexmount oscillating conveyors in any desired length can now be ordered and built by the purchaser from factory sub-assemblies available from stock. Book No. 2478 from Link-Belt Co., Chicago, Ill., tells how to select the conveyor to fit your needs, how it's constructed and how it works. (52)

SHELF STORAGE. "The Science of Economical Shelf Storage" tells how you can save up to 50% floor space and reduce material handling costs up to 50% with Rotabin rotary shelving. There are also other benefits for harassed warehousemen discussed in this bulletin by Frick-Gallagher Mfg. Co., Wellston, Ohio. (53)

DETACHABLE DRILL BITS. Here are four pages crammed full of information about the new Liddicoat detachable drill bit made by Wolverine Tube Div., Calumet and Hecla Consolidated Copper Co., Detroit, Mich. (54)

HYDRAULIC TOOLS. "1001 Valuable Shortcuts with Hydraulic Tools and Hand Tools" constitutes the 64-page "Idea Book" available from Blackhawk Mfg. Co., Milwaukee, Wisc. No matter what your plant or mine job is, 5 will get you 10 you'll get a flock of good ideas out of this. (55)

SPRAY NOZZLES. Anyone interested in spray nozzles for washing sand, coal, ore, concentrates, or for any other mine or quarry application, will find a wealth of information in a new 40-page Industrial Nozzle bulletin just published by Binks Mfg. Co., Chicago, Ill. (56)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after December 1, 1952, if mailed in U. S. or Canada

Engineering & Mining Journal—October, 1952
NOT GOOD AFTER DECEMBER 1, 1952—If mailed in U. S. or Canada

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	22	29	36	43	50	57	64
2	9	16	23	30	37	44	51	58	65
3	10	17	24	31	38	45	52	59	66
4	11	18	25	32	39	46	53	60	67
5	12	19	26	33	40	47	54	61	68
6	13	20	27	34	41	48	55	62	69
7	14	21	28	35	42	49	56	63	70

My Name ..... Position .....

Company .....

Address .....

Equipment Shorts

EMERGENCY LIGHTING. You can prevent sudden lighting failure with Exide "Lightguard." The self-contained unit instantly and automatically turns on powerful floodlight when current fails and will give up to six hours adequate lighting. Electric Storage Battery Co., Philadelphia, Pa. (22)

METALLIZING. Maintenance men will be interested in the story of how a midwest chemical plant saved $16,000 in one year in reconditioning worn cylinders in the plant's 14 gas engines. Engineers had three choices for reconditioning engines which showed wear in top third of combustion cylinders: (a) replacement at $450 per cylinder; (b) reboring cylinders and using oversized pistons and rings at $400 per cylinder which gives each engine a different bore, and parts are no longer interchangeable; (c) metallizing at $150 per cylinder, including purchase of horizontal boring mill and vertical honing machine, plus a shop-made rig for preheating cylinders before spraying. Metallizing Engineering Co., Long Island City, N. Y. (23)

ANTI-RUST PAINT. Paint Corporation of America, Cleveland, Ohio, has added a new aluminum anti-rust paint to its line. Because it uses a clear anti-rust base, the manufacturer claims the paint can be applied without the base bleeding through, a phenomenon that seems to plague many aluminum paints using an asphalt or bituminous base. (24)

DYNAMIC BRAKING. Aiming at the savings in car-wheel and brake-shoe maintenance made possible by dynamic braking, Baldwin-Lima-Hamilton Corp. recently applied this type of braking to a diesel-electric switching locomotive. The diesel, direct-connected to its generator, feeds four traction motors on the four axles. The switcher incorporates Baldwin's pneumatic speed control which has no transition points. Motors remain permanently connected in the circuit. Speed is regulated by traction-motor field shunting and engine governor adjustment through a pneumatic throttle. (25)

ALUMINUM WELDING. If welding aluminum is a problem for you, you'll want to learn more about "Chemalloy" which is billed by its manufacturer as "an improved and simplified means for the soldering and welding of aluminum." Chemalloy Associates, Santee, Calif. (26)

ENGINEERING SERVICE. Computer Corporation of America (New York, N. Y.) has inaugurated a service which furnishes solutions to complex problems in dynamics for industrial, government, and research organizations. The company makes the "IDA" analog computer, but points out that problems in all engineering fields will be accepted for analysis and solution whether the computer is required or not. (27)

PILLOW BLOCK. Dodge Mfg. Co., Mishawaka, Ind., and Timken Roller Bearing Co. have pooled their know-how to make an all-steel pillow block with "high radial and thrust capacities and the stamina to take heavy shock loads . . . within minimum dimensions and with far less than usual weight." (28)

FLOORING. Try "Latex-O-crete" to protect your floors from the destructive action of chemicals. You can apply it directly over the old surface at an average depth of ¼ in. Only preparation is thorough cleaning. United Laboratories, Inc. (29)

SAMPLER. A 12-in. short stroke sampler features a right angle cut across the stream to be sampled, taking equal percentages from all parts of the stream. By means of a timer, cut can be made automatically as frequently as desired and interval between cuts remains constant. Three types of cutter heads are available for wet and dry materials flowing under different conditions. Galigher Co. (30)

ACID-PROOF HOSE. Over at Hewitt-Robins, Inc., Stamford, Conn., they're working on a rubber hose that will be resistant to acids in concentrations that formerly prohibited the use of rubber hose. The product is now undergoing tests. (31)

TEMPERATURE CONTROL. An instrument that goes by the intriguing name of "Alnor Pyrotac" automatically monitors up to 20 separate temperature points a minute. Illinois Testing Laboratories, Inc., Chicago. (32)

MOLTEN METAL METER. Magnetic flowmeter offers remote measurement of molten metal flow with maximum safety. Any potentiometer can be used to measure the meter's voltage output. General Electric Co. (33)

TEFLON. This tough anti-corrosion material is now available in more forms: shaved tape, molded sheets, molded round tubing, beading, and extruded and molded rod. Ethylene Corp., Summit, N. J. (34)

FORGING FURNACE. The "Forgeatrol" furnace confines heat to the chisel point or bit to prevent loss of temper in the shank during tool redressing. In most cases shank remains cool enough to forge without tongs. Heat is quick and uniform, and can be controlled between 1200°F. and 2800°F. Delaware Tool Steel Corp., Wilmington, Del. (35)

POCKET SIZE VOLT-AMMETER is the snap-around type that permits user to measure current instantly without shutting down or making ammeter connections. Unit has nine ranges up to 300 amps and 600 v. Pyramid Instrument Co., Lynbrook, N. Y. (36)

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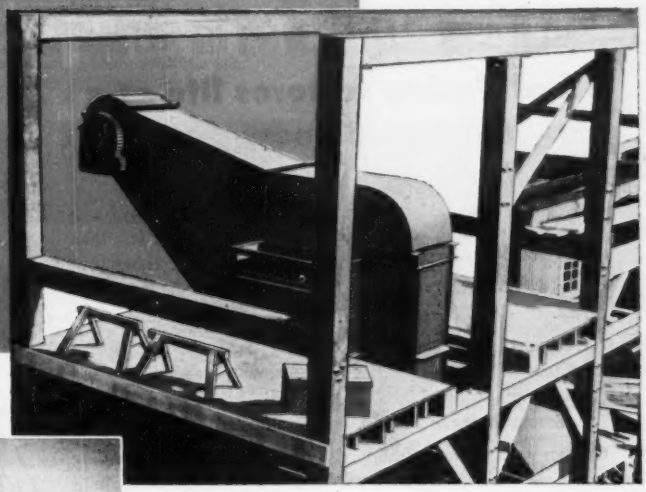
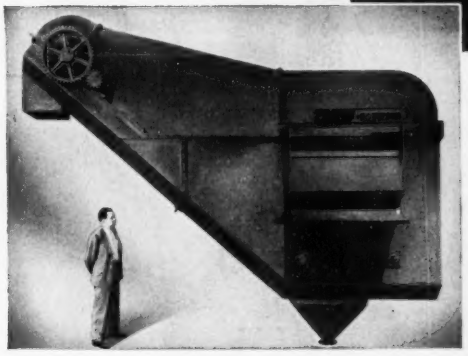
to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, on reverse side, tear out and mail.

50% LESS FLOOR SPACE

Needed for *New* Wilmot-Daniels Heavy Density Unit

Unequalled Compactness Results from Its Complete-in-1-Unit Construction and Elimination of 5 Major Parts and 4 Motors. Unit Is also Custom-Designed to Fit Your Space. New System Eliminates the Two Most Common Heavy-Media Problems.





Above, size 150-A Wilmot-Daniels Heavy-Density unit; feed capacity, 150 tons per hour. Also available in sizes for finished product capacities of 50 to 500 tons per hour. Wilmot-Daniels units are furnished in 4 types to fit varying plant set-ups. All are of the complete-in-1-unit construction shown above.

The really revolutionary nature of the advances in efficiency made by the new Wilmot-Daniels heavy-media unit is indicated by the fact that it requires 50% less floor space. To this real reduction in capital cost, add the direct saving that results from the fact that the Wilmot-Daniels Heavy-Density unit is custom designed to your requirements and local conditions. You are not forced to adapt your plant to a "package" unit.

Remarkable simplicity is another advanced feature. The unit contains 5 less major parts and 4 less motors. It employs many standard parts for ease of maintenance. The refuse conveyor, for instance, is of the conventional flight type.

Let us send you Bulletin 521 describing the complete technical details of how this new system operates to increase yield and promote product control for both metal and coal producers.

Send for **BULLETIN 521**

WILMOT

WILMOT ENGINEERING CO. HAZLETON, PA. *Plant:* WHITE HAVEN, PA.

HEAVY DENSITY DIVISION

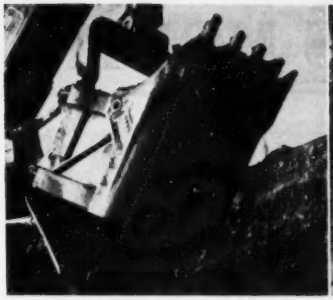
Stoody Alloys save shovel parts!

Hard-Facing restores life at a fraction of new part cost!

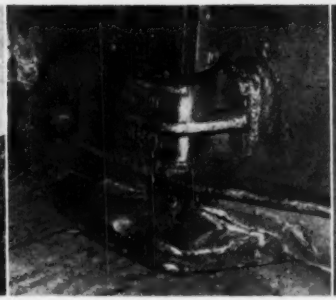
You can get new and longer life from worn shovel parts by hard-facing with Stoody Alloys! Cost of reclamation is far less than for new parts. Regular maintenance procedures thereafter save costly down-time, spare parts inventory and needless replacements.

Check your shovels today against the suggested rebuilding operations pictured at the right. Detailed manual procedures are described in the new revised STOODY GUIDEBOOK. Get it from your Stoody dealer or by mail.

Custom welding shops equipped to handle automatic rebuilding work are located in every section of the United States and Canada. Write for list of shops near you.

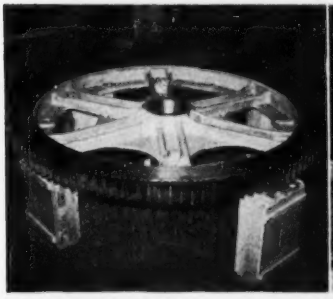


1 **BUCKET TEETH, LIPS, SIDES, BOTTOMS**
ALLOY: *Stoody Self-Hardening 21 or Stoody 1027.*
APPLICATION: *Manual—stringer beads or solid overlays on wear areas.*
RESULTS: *Maintains size, reduces wear, retains full bite and load.*

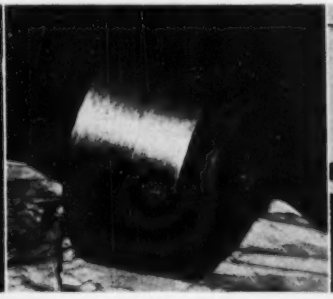


2 **LATCH PLATES AND KEEPERS**
ALLOY: *Stoody Self-Hardening or Stoody 1027.*
APPLICATION: *Manual—build to size and peen to shape while red hot.*
RESULTS: *Effects positive latch closure. Negligible cost.*

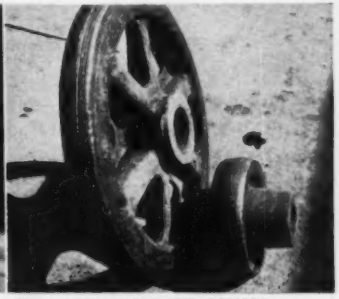
3 **SHEAVES**
ALLOY: *Stoody 104 or Stoody 107.*
APPLICATION: *By automatic—machinable deposit.*
RESULTS: *Prevents grooving, increases rope life.*



4 **HOUSE BASE RINGS**
ALLOY: *Build up with Stoody 104, finish with Stoody 107.*
APPLICATION: *By automatic—machinable surface.*
RESULTS: *Reclamation ¼ of new ring cost.*

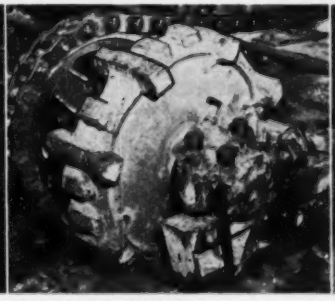


5 **HOUSE ROLLERS**
ALLOY: *Stoody 107.*
APPLICATION: *By automatic—machinable surface.*
RESULTS: *Restores contour, doubles life at 1/3 the cost.*

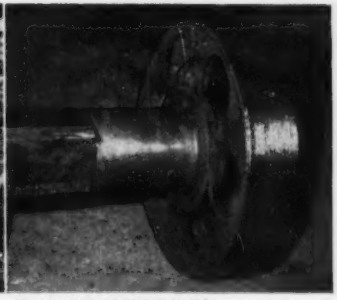


6 **SHOVEL IDLERS AND ROLLERS**
ALLOY: *Stoody 105.*
APPLICATION: *By automatic—no finishing necessary.*
RESULTS: *Restores wearing faces, doubles life at ½ original cost.*

7 **TRACK PADS**
ALLOY: *Stoody 1027.*
APPLICATION: *Manual—rebuild with Stoody High Carbon, overlay with Stoody 1027.*
RESULTS: *Doubles life at ½ cost.*



8 **DRIVING TUMBLERS**
ALLOY: *Coated Stoody Self-Hardening or Stoody 1027.*
APPLICATION: *Manual—rebuild drive lugs.*
RESULTS: *Doubles life at ½ original cost.*

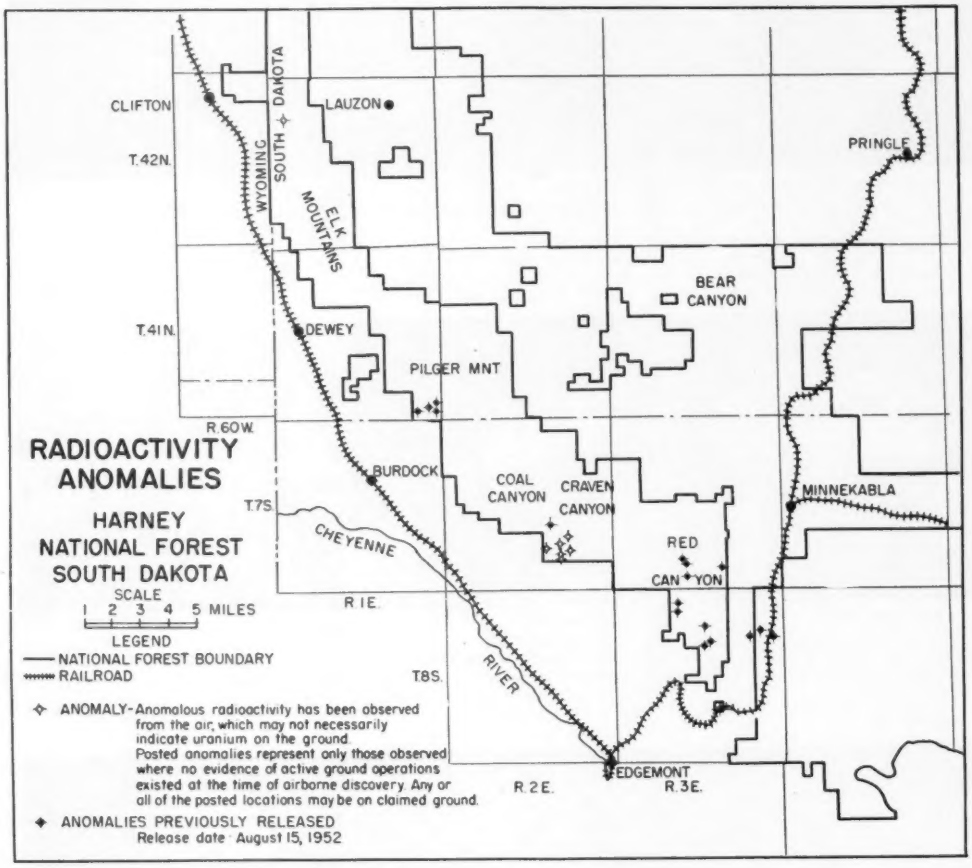


9 **SWING BRAKE DRUMS**
ALLOY: *Stoody 106.*
APPLICATION: *By automatic—machine to finish.*
RESULTS: *Illustrated type reclaimed for 15% of new cost, outlasts new drum.*

See the "yellow pages" in the phone directory for your local Stoody dealer, or write for dealer list and complete literature

STOODY COMPANY

11940 E. SLAUSON AVENUE, WHITTIER, CALIFORNIA



Uranium Makes News . . .

In the U.S., AEC Helps the Prospector . . .

TO HELP PROSPECTORS find more uranium orebodies, the U. S. Atomic Energy Commission is telling the public where its scintillometer-equipped planes have detected radioactive anomalies. The commission carefully states, however, "... locations at which anomalous radioactivity has been observed from the air ...

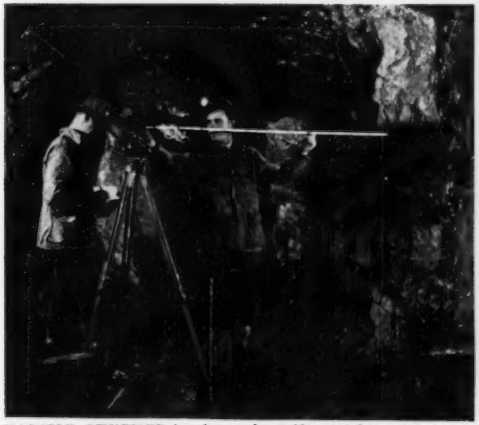
"The information will relate only to locations at which anomalous radioactivity has been observed from the air and may not necessarily indicate the presence of uranium on the ground."

On the 15th of each month (or the first succeeding working day if the 15th falls on a Saturday, Sunday or federal holiday), the AEC posts index maps like the one above showing anomalies revealed by airborne detection instruments over the previous month. AEC planes are covering several widely scattered areas, and maps are posted at the following offices:

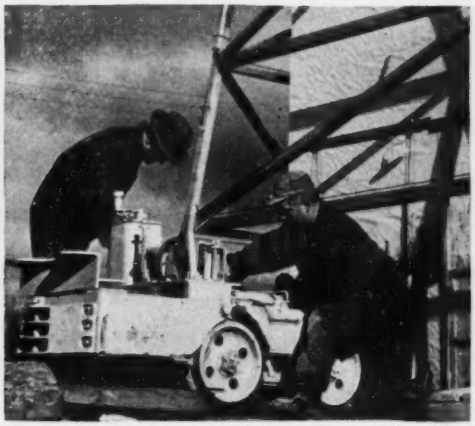
New York Raw Materials Office, New York City, N.Y.
Denver Exploration Branch, Denver Federal Center, Denver, Colo.
Hot Springs Sub-office, Hot Springs, S.D.
Bureau of Mines Office, Rapid City, S.D.
U.S. Geological Survey Office, Custer, S.D.
Grand Junction Exploration Branch, Grand Junction, Colo.
Grants Sub-Office, Grant, N.M.
Salt Lake Exploration Branch, Salt Lake City, Utah.
Richfield Sub-Office, Richfield, Utah.
Butte Sub-Office, Butte, Montana.

Timing is important, and AEC strives to post maps simultaneously.

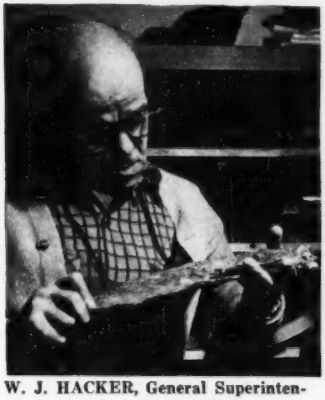
IN MINING



TAKING OFFSETS in the main drift of Eldorado's Ace mine at Beaverlodge are Del Ney and helper, Howie Powell.



NEW TRAMMER is assembled by James Quill and Joe Duquette at the headframe of the Ace Mine.



W. J. HACKER, General Superintendent at Beaverlodge.

AIRBORNE SUPPLIES from Edmonton are unloaded at Beaverlodge almost all year around.

. . . In Canada, Beaverlodge Pushes for Production

AT BEAVERLODGE, near the old mining town of Goldfields (see map, right), Eldorado Mining and Refining Co. is preparing for production the mines that may well restore Canada to its former position as the world's second largest uranium producer. By 1953, the Crown company will have invested $8-million in the new finds at Lake Athabaska, Saskatchewan, and should begin hoisting ore at the rate of 500 tons a day. They will eventually handle 2000 tons per day.

Deposits in the area are the vein type containing primary uranium. Although most of the development to date has been done by Eldorado, a number of private companies hold claims and plan development. Many are already doing preliminary work.

Transportation is a problem. During the summer much of the material needed for construction at Beaverlodge can be transported on the Athabaska River, which flows into the west end of Lake Athabaska. Air transportation, however, is relied upon for a substantial portion of the men and material which go into the new project.

(*Continued on page 132*)

Politics, Corruption Impede Korean Mining Progress

POLITICAL PATRONAGE for incompetents, corruption and Eighth Army "office politics" are hamstringing development in South Korea of a mining industry capable of supplying important additions to the free world's need of critical metals, and vital to the beleaguered nation's economy.

Appointment of a politician and former minister of home affairs to head Korean Mining Development Corp. typifies the encroachment upon private business. Said a competent mining engineer on the staff of a UN organization, referring to *E&MJ's* editorial admonitions on the danger of government control to the mining industry: "Korea is a real object lesson in why we should do everything to keep government out of the mining business."

The numerous small-scale producers usually fail to find a foreign market, because they run out of capital before they can stock sufficient ore and concentrate it to a grade acceptable in the export market. The problem might be solved by a buying agent able and willing to invest considerable capital. He would amass the widely scattered small quantities of low-grade ore, paying the miners cash on the barrelhead so they need not interrupt mining operations to seek more capital. He could then upgrade the ore in big lots and find a profitable export market for it.

No buying agent intrepid enough to try this has appeared. First, he'd have to obtain an export license from Syngman Rhee's government. If this were possible, it would probably entail exorbitant pay-offs to Korean politicians. There's a greater likelihood that it's impossible. The government gained a strong political prop when at the end of World War II the Japanese turned over monopolistic control of the country's mineral resources. It might not be willing to relinquish this at any price.

Even if an agent were able to make satisfactory arrangements with the government at the outset, he would find in the highly unstable and unsavory political climate little assurance that profitable conditions would last long enough for him to recover his investment.

A government trading company was established to provide a mineral marketing agency, but it's dying already. Diagnosis is the greed of political appointees with little or no business experience who were named to staff the agency. The agency lobbied successfully for laws forcing nearly all mineral business through the government company. What private business then existed was driven to the wall or converted to smuggling. A further decline in mining output was the inevitable result.

Tungsten mining, centered at Sangdong a little south of the 38th Parallel in Central Korea, leads all other South Korean mineral production in value and importance, though the current 2400-ton-a-year output is but a small part of the potential. The Mining Bureau of the Ministry of Commerce and Industry estimated annual production of exportable tungsten five years from now would reach 5000 tons, and UN mining experts regard the bureau's estimates as too conservative.

The civil war interrupted Korean Tungsten Mining Company's project to build at Sangdong with ECA help a new mill designed on the basis of tests conducted at Allis-Chalmers research laboratories.

Since South Korea recovered Sangdong, the able management of Ahn Bong Ik, of Korean Tungsten Mining Co., initiated appreciable mine and mill improvements. Ahn ordered and installed jackbits, jacklegs and slushers in the mine and put sand cones ahead of the tables in the mill. It is estimated tungsten recovery will rise to 60-65%, compared to a previous low of 40%, when he installs new crushers procured by ECA. He plans to build the new mill next year and operate it according to the Allis-Chalmers flowsheet, retaining the old mill and using both as long as the market warrants. Should prices drop, the old one would be shut down.

(The original plan was to shut down half the old mill, replace it, then shut down and replace the other half.)

Ahn's success is jeopardized by the possibility a Pusan labor leader will attain his ambition to manage the mine. A loyal supporter of President Rhee, it's fair to assume he is more able in political connivance than in mine management. He is not a mining engineer and has no mining experience.

Another irritant is the machinations of Eighth Army's Civil Assistance Section, which for months has classified as secret all information bearing on tungsten operations, although all information of a technical or business nature may be obtained without question from both Korean Tungsten Mining Co. and the Mining Bureau. One American mining engineer with long experience in Korea interpreted this to mean CAS, which built roads, provided transportation to the mine and rehabilitated power plants at Sangdong, is jealous of any credit that may be given others. When Washington ordered the Far East Command to take an interest in rehabilitating Sangdong, CAS usurped the right of exclusive control over strategic minerals in South Korea. (One effect was to nullify an agreement of the UN Korea Rehabilitation Agency to underwrite test drilling of what appear to be excellent **columbite** deposits near Muju, southeast of Taejon.)

Ironically, Sangdong suffered greatest damage in the hands of Republic of Korea troops, who tore down buildings for fire wood, smashed windows and looted parts, motors, belts, electrical equipment and reagents. The invaders from the north, on the other hand, cleaned and greased the machinery and sought to preserve equipment. Said one UN observer: "The hand of a subtle white man was apparent in the Reds' action."

Estimated cost for the new mill is $1.5-million, comprising roughly equal expenditures in foreign exchange for machinery and in local currency for labor and construction.

Although Korean engineers are credited with a good job, U. S. and UN mining engineers are recommending to the Korean Government that it make a foreign management contract effective until a larger force of experienced Korean personnel is trained.

A second major tungsten mine at Dalsong is much smaller than Sangdong and has no immediate prospect of appreciably increased productivity.

Effect of political intrusion upon the industry is graphically shown by fluctuation of **gold** productivity. In the first three months after enactment January 23 of a law permitting free sale of gold on the open market, more gold was produced than in any full year of the 10 years sales were restricted to the Bank of Korea. Last year the bank offered prices ranging from one-fourth to one-tenth market value, and no one sold to the bank. The industry went underground as investment capital disappeared, and gold mining sank to pillar robbing and sniping projects. Current annual production is less than 1 ton. Yet the bank is playing politics to regain its ruinous market option by attempting to influence the Chunghung Refinery of the government-vested Samsung Mining Co. to sell gold to the bank at a fraction of its worth. If the bank succeeds, the refinery will go broke.

Nor does Korean private enterprise aways serve the best interests of the mining industry. About three years ago, a Korean firm obtained on the basis of excellent samples a Japanese contract for 3000 tons of **kaolin**, shipped about 1000 tons of good kaolin and 2000 tons of what could be best described as "rice paddy mud." There haven't been any new Japanese contracts, though Japan is close enough to provide a lively market for the low-unit-cost mineral, and only a small fraction of the potential kaolin reserves is being worked.

The Mining Bureau estimated South Korea five years from now could produce about $40-million worth of exportable minerals annually. UN mining experts, pointing out most mining (other than tungsten) is outcrop working that might be made far more profitable and continuous by consolidation of numerous small operations, say the estimate is too conservative. The bureau's figures (in tons) are:

Tungsten	5000
Bismuth	540
Molybdenum	50
Gold	5
Copper	600
Lead	1200
Zinc	2000
Columbite	1000
Monazite	1000
Fluorite	5000
Crystalline graphite	5000
Amorphous graphite	60,000
Talc	8000
Kaolin	15,000

The situation mineral by mineral shapes up like this:

Molybdenum: Production is less than 10 tons annually, and none is exported.

Copper: Chunghung's copper-refining capacity far exceeds South Korean needs. Before the Japanese surrender, it received copper ore and scrap from North Korea. Only recently have refinery managers been persuaded to re-schedule operations so that a couple of small furnaces operate continuously, rather than that all furnaces operate full blast and intermittently. This change and a diversification of refining have led to more economical operations, affecting lead and zinc production as well.

Monazite: Several outcrops are yielding only small quantities. A ready, cash market would boost production sharply.

Fluorite: Current annual production estimated at 3000 tons would be increased if a steady market were developed.

Crystalline graphite: There is no production, but good deposits await exploitation. Japanese drilling analyses indicate one field southwest of Seoul at Shiheung contains 30-million tons, and a UN mining engineer was even more optimistic. "I saw enough on the surface," said he, "so that I would be willing to build a 200-ton mill." The deposit, which contains better than 30% grade A material, could be mined with slushers.

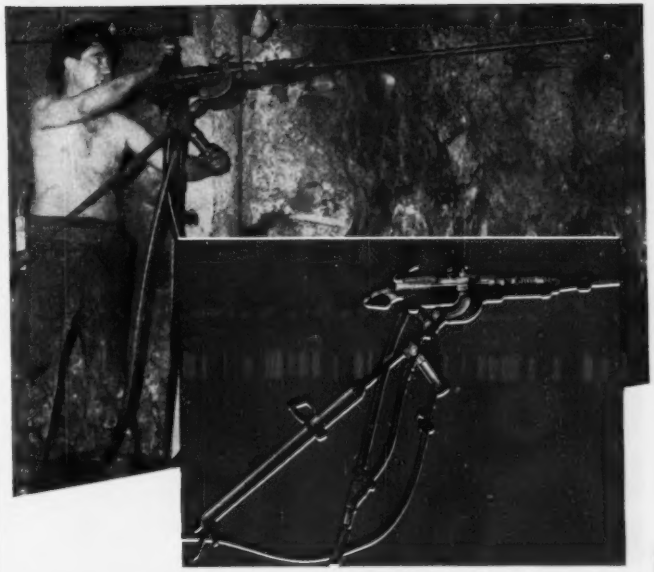
Amorphous graphite: Development of nearby markets for the low-unit-cost mineral could be counted on to increase rapidly the limited present production.

Talc: Most present production of about 5000 tons is shipped raw. Deposits containing large quantities of pure, flawless talc could be sawed into block talc of high value.

What U. S. Will Pay for Columbium-Tantalum

UNDER THE GOVERNMENT'S PROGRAM for the expansion of production of columbium-tantalum ores and concentrates of both domestic and foreign origin, the Defense Materials Procurement Agency has agreed to purchase a minimum of 15-million lb. of contained combined pentoxide (Cb_2O_5 plus Ta_2O_5).

The program is to terminate on



YOU MUST SEE IT TO BELIEVE IT

*Five out of six mine operators buy *COPCO rock drilling equipment when they see it demonstrated.*

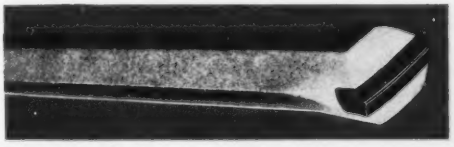
When one man can outdrill two, it's no wonder so many operators are changing over. Every western mining town is buzzing with talk about this new Swedish rock drilling method.

The ***COPCO COMBINATION** is light in weight, but it's rugged and powerful. One miner can set up and drill out easier and faster than two men can use conventional equipment.

***COPCO ROCK DRILLING EQUIPMENT**

Atlas Rock Drill — Light, tough, and hard hitting, it sets up quickly and simply on the Atlas pusher leg.

Sandvik Coromant Steel — Swedish alloy steel rod with an integral tungsten carbide bit, it cuts 50 to 200 feet of hard rock before resharpening.



WRITE FOR FREE DEMONSTRATION AT YOUR PROPERTY

(Presently demonstrations are limited to the western states)

COPCO PACIFIC, LTD.

930 BRITTAN AVENUE, SAN CARLOS, CALIFORNIA

BRANCH OFFICES AND WAREHOUSES AT SPOKANE, SALT LAKE CITY, DENVER AND PHOENIX.

today's best buy is better air!

Feed end of picking table . . . source of excessive coal dust prior to Type N ROTO-CLONE installation.

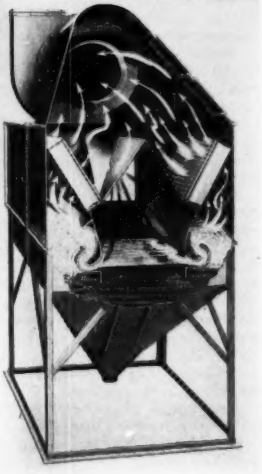
clean faces in a coal mine!

ROTO-CLONE'S Efficient Dust Control Lowers Operating Costs With Clean Air.

Clean Air soon proves a sound investment in today's mechanized coal mining operations. Here's only one example. Before a Type N ROTO-CLONE was put to work, the picking table shown above was one of several sources of excessive dust concentrations. Other methods of dust suppression used by the operator had proved inefficient . . . and costly . . . since they reduced the quality of the coal after processing.

The ROTO-CLONES, however, solved these dust problems efficiently and economically . . . cutting operating costs in several ways. Man-hours were saved, mechanical efficiency improved, maintenance costs dropped . . . and coal quality was unimpaired.

The many types, sizes, and arrangements of ROTO-CLONE dust collectors have solved almost every dust problem in the mining cycle. If dust is dissipating your operating dollars, call your nearby AAF representative or write direct to us. We will gladly furnish complete information . . . including case histories.



Cross section of Type N ROTO-CLONE arrangement D with dual impeller showing water curtains created by air flow. Exclusive design eliminates moving parts while maintaining highest efficiency.

Typical Dust Sources Exhausted by ROTO-CLONES

- DRYERS
- SCREENS
- CRUSHERS
- CONVEYORS
- FEEDERS
- PICKING TABLES

American Air Filter
COMPANY, INC.

193 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd. Montreal, P. Q. • Pacific Division Office, San Francisco, California

This Month in Mining (*Continued*)

Dec. 31, 1956, or when the government has purchased 15-million lb. of contained pentoxide.

Any seller may offer for sale to the government columbium-tantalum bearing ores and concentrates of either domestic or foreign origin.

Specifications and Price

The government shall pay the following price for ores and concentrates meeting the following specifications, determined on a dry weight basis:

(a) For columbium ores and concentrates containing not less than 35% combined Cb_2O_5 and Ta_2O_5 and having a Cb_2O_5 and Ta_2O_5 ratio of not less than one to one, impurities not to exceed the following maximum limits:

	Percent
TiO_2	8
SnO_2	8
FeO	25
MnO	13

$1.40 per lb. of combined contained pentoxide, plus 2c per lb. for each additional full percent of combined contained pentoxide above 55%.

(b) For tantalum ores and concentrates containing not less than 25% Ta_2O_5 and less than 20% Cb_2O_5, and containing not in excess of the following maximum impurities:

	Percent
TiO_2	4
SnO_2	4

$3 per lb. of contained Ta_2O_5 in ores and concentrates containing 30-40% Ta_2O_5 plus 3c per lb. for each additional full percent of contained Ta_2O_5 above 40%, plus an additional 4c per lb. for each full percent of contained Ta_2O_5 above 50%.

Penalty: For tantalum ores and concentrates containing between 25 and 30% of Ta_2O_5, 6.0c per lb. will be deducted for each full percent of contained Ta_2O_5 under 30%.

(c) For columbium-tantalum ores and concentrates containing 25% or more of Ta_2O_5 and 20% or more of Cb_2O_5, and containing not in excess of the following maximum impurities:

	Percent
TiO_2	4
SnO_2	4

$1.60 per lb. of combined contained pentoxide in ores or concentrates containing a minimum of 45% combined pentoxide, plus 2c per lb. for each additional full percent of combined pentoxide above 45%.

(d) Columbium - tantalum - bearing ores and concentrates failing to meet the specifications set forth in paragraphs (a), (b) and (c) of this section will be considered for purchase by the government provided the seller bears the cost of upgrading to the minimum specifications.

(e) Bonus: For lots meeting the above specifications, an incentive bonus amounting to 100 percent of the

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EASIEST WAY TO MAKE ENDS MEET

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COMPANY OF AMERICA
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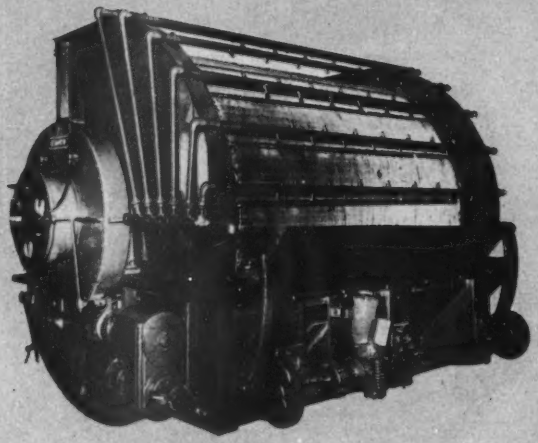

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This Month in Mining *(Continued)*

price specified in paragraphs (a), (b) and (c) of this section will be paid on all accepted deliveries, except that no bonus shall be paid on any lot previously owned by the government.

Purchasing Agents

The Fansteel Metallurgical Corp., North Chicago, Ill., the Wah Chang Corp., New York, N. Y., and the Emergency Procurement Service of the General Services Administration shall act as purchase agents for and on behalf of the government under this program. Offers of ores to the government under this program shall be made to such agents. Purchases made hereunder by the Emergency Procurement Service shall be for the national stockpile.

Deliveries of all purchases made under this program shall be in lots of not less than 2,000 lb and shall be (a) in the case of materials of foreign origin, c.i.f. Atlantic ports, and (b) in the case of materials of domestic source, f.o.b. depot of purchasing agent.

Each lot offered to the government hereunder shall be accompanied by a certificate disclosing the identity of the actual producer. In the event the seller is not the actual producer of the ore, the seller shall receive payment only in the amount of the base purchase price, and the bonus payment shall be paid by the government direct to the actual producer.

IN THE UNITED STATES

ALABAMA

★**Woodward Iron Co.** plans construction of a Heavy-Media-Separation plant at its Pyne Ore mine, according to President Bradford Colcord. The new installation will be located south of Bessemer and will have a capacity for washing 300 tons of red iron ore per hour. The Heavy-Media-Separation plant will give the company a better raw material for the blast furnace, which will result in increased furnace production of pig iron.

ALASKA

★It has been reported at Fairbanks that **"a very rich deposit" of cassiterite** has been found on Cape Creek on the Seward Peninsula by exploratory work of **Zenda Gold Mining Co.** Drilling is proceeding at Cape First Chance and Boulder Creeks near Tin City. Norman C. Stines is directing the work, and results will determine whether a dredge should be installed. A later report says such a favorable

prospect has been discovered at the Teller tin property that an additional $60,000 loan has been approved by DMEA for further development work.

★A tungsten property 20 mi. from Nome, leased by **Yukon Placers, Inc.**, will be trenched with a bulldozer. A copper property on Fidalgo Bay is also being developed by the company.

★Territorial Commissioner of Mines Phil R. Holdsworth and James Williams have investigated **"lodestone" in the Chilkoot Range** near Klukwan at the request of C. T. Takahashi, whose company, of Seattle, Wash., holds an option on the Alaska Iron Co. property. They report an unbroken deposit of fairly clean magnetite on the mountainside. The exposed deposit was followed from 1,350 ft. to 3,700 ft. altitude without reaching the limit. Width and depth were not determined. Geologic reports show 30 to 70% iron.

★Articles of incorporation were filed recently at Nome by a company to be known as **Alaska Tin Corp.** which is to be headed by three Nome men, Carl Lomen, Harry Gabrielson, and Ralph Lomen.

ARIZONA

★Government is considering establishment of **a mill** and other facilities in Arizona to handle **crysotile asbestos** from independent producers. Most of the Arizona production is in the Globe-Miami area of Pinal County. The plant would encourage production of long-fiber, low-iron asbestos that exists in many places in Arizona.

The DMPA plans to contract with a private firm for establishment of a processing plant in which raw asbestos can be treated to meet specifications of the national stockpile and industry requirements.

★**Valuation of the Tennessee Schuylkill** zinc mine at Chloride in Mohave County has been cut from $82,325 to $37,055 for tax purposes. The request for reduction was made by the receiver for the mine, who is attempting to reorganize the firm and get the mine back into production. The property has been idle for several years.

★**Speaking against additional levies on Arizona mining,** Charles Kuzell, general manager of western operations for Phelps Dodge Corp., told Arizona chamber of commerce executives that pending legislation to put additional taxes on mining "would well mark the beginning of the killing of the goose that lays the golden egg."

Arizona this year votes on a proposal to double the 1% production tax now paid by mining firms. He said that Arizona mining firms will risk $191-million in the next few years before a single ounce of ore is produced. He noted that the industry last year paid $9-million in property taxes in Arizona. Property is assessed at nearly 100% of value, and the industry pays a 2% sales tax, plus the levy on production.

★A floor-price metal purchase contract guaranteeing a minimum return of $184,472,000 on government purchase of copper and molybdenum assures full development of the $121-million Mammoth-Tiger copper district.

San Manuel Copper Corp., a subsidiary of Magma Copper Co., is developing the low-grade deposit in Pinal County.

CALIFORNIA

★**Blue Ridge Gold Mines Co.** is trucking 25 to 30 tons of tungsten ore daily from the Hilton Creek mine to U. S. Vanadium Corp.'s mill near Bishop.

Access road to the Tip Top tungsten mine has been cleared of snow and ice banks, repaired and improved, and the shaft repaired preparatory to installation of hoisting machinery and compressor. Ore in the shaft runs 1% or about $63 per ton, and shipments will begin soon. Both these properties are held under a five-year lease by Blue Ridge and are located in Mono County.

★**Garnet King tungsten mine** will swing into full production this month with the installation of a 100-ton mill at the property east of Big Pine, Inyo County. Ore is now being stockpiled pending completion of the new plant, according to W. H. Allured, one of the five Garnet King Mining Co. owners. A new jaw crusher and other installations are being added, and ten men are employed at present.

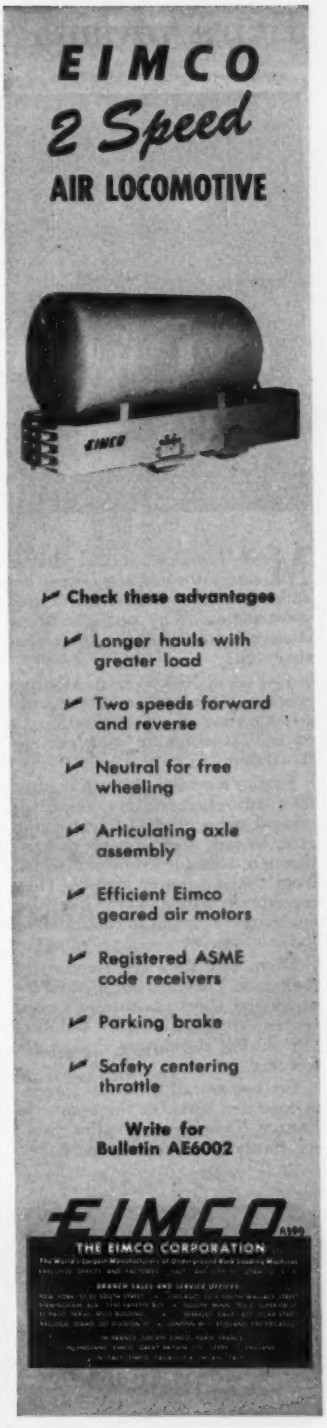
Other owners include John H. Olson and Weir Cassidy, Hollywood building contractors, Kenneth Fletcher and Major E. Allured.

★**Expansion is under way** with underground exploration at Penn mine near Campo Seco, Calveras County, **by New Penn Mines, Inc.**, which recently purchased a controlling interest from Penn Chemical Co.

A new ball mill is being installed, and additional flotation cells are being put in. An increase of 40% in the payroll is expected when the expansion is completed within four months. Production capacity will be 150 tons of ore per day. Copper and zinc are mined as sulphides. Harold Hanjen is mine superintendent.

COLORADO

★**Slate River Mining Co.** is trying to get the Micawber mine near Gunnison into production. The mine shipped 2,000 tons of ore last summer, the first production in many years, to Midvale, Utah, for processing. R. E. Simpson, president, believes a mill in that area will revive several dormant mines.



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Colorado *(Continued)*

★**Moreno-Cripple Creek Corp.** has started a crew working on its properties near Silverton, in the San Juan district. A contract will be let to drive ahead on the vein underlying the orebody already opened up in the old workings above. While these are primarily lead-zinc properties, the ore assays well in both gold and silver.

★Test runs are being made on new additions to the **Herron Brothers' 100-ton gravity mill** at Aspen. John L. Herron, manager of the Henry Clay mill, expects soon to have it in operation on a three-shift basis. A late-type rod mill to crush the ore to a 24 mesh and new elevators to handle the crushed ore have been installed. An additional Wilfley table will be in operation to make three tables in all. The mill feed consists of good grade ore taken out of No. 1 and No. 2 Smuggler tunnels and selected spots in the old Smuggler and Mollie Gibson dumps. Several thousand tons of mill dirt are also available in the tunnels.

★Six lots of ore have been shipped from the orebody recently discovered by **Globe Hill Mines, Inc.**, at Cripple Creek. Average value of two lots settled was $11.50 a ton, a little better than average value of thousands of tons shipped from this property.

★A. B. Calloway, owner of the **Nellie Bly lode**, reports that he has opened up a 4 ft. vein carrying gold ore assaying $28 to $35 per ton. The mine is 4 mi. southeast from Buena Vista in Chaffee County on Highway 24. Calloway reports that they are shipping ore this week.

★**Gold ore receipts** at the Golden Cycle mill at Cripple Creek for July were 15,242 tons. This is the largest monthly tonnage since the mill started. The best previous month was 13,721 tons. From two to three gold bars are poured each week.

★A contract to build 49.5 mi. of **uranium access roads** on the Western Slope has been awarded to the Alger Construction Co. of Lakewood by the state highway department.

★**Golden Cycle Corp.**, C. H. Carlton, manager, reports **a big stope of ore** appears to be in the making on the 3,000-ft. level of the Ajax mine at Cripple Creek. When this stope was started on the Bobtail vein, nine chutes were required to handle the 6 to 8-ft.-wide vein. Now 11 chutes are under the stope. On a mine run basis, the ore has been running $10.51 to $17 of gold to the ton.

★Members of the **Colorado Section** of the American Institute of Mining and Metallurgical Engineers **held a two-day meeting** in Cripple Creek. About 80 persons, including wives of the members, were on hand for the first Cripple Creek conclave of the group. Headlining the meeting was the address of Dr. Donald H. McLaughlin of San Francisco, Calif., president of the

Homestake Gold Mining Co. The meetings opened with a technical session at the Carlton Mill. Max Bowen, who is manager of the mill, was in charge of the meeting. A field trip was made through the mill and the 27th level of the Ajax mine.

★Canyon Gold, Inc., has started what looks like **a good stope** on the 11th level of **the Rubie Mine** at Cripple Creek. Grab samples run from $28 a ton into high-grade. The first shipment has been made.

★**At the Cresson mine** in Cripple Creek, the 2,100-ft. level now has four chutes under one stope of ore; the vein is 10 to 12 ft. wide. Ore has been cut in a ventilation raise to the 20th level and recently a new orebody was cut in one of the drifts on this bottom level.

★**The Bemrose Placer** at Breckenridge is again operating. The Bemrose is one of the historic rich producing placers of Summit County. Bill Gray and Irving Maestas of Colorado Springs are operating the venture, and cleanups made daily so far have exceeded expectations with recoveries said to be running nearly $3.50 a yard.

GEORGIA

★With increased government purchases of book and sheet mica for stockpiling, several **mica mines** in Georgia are **preparing to reopen.** Most have been closed since the end of World War II.

★**The Mitchell Creek mine** at Thomaston, which was operated during the war by Sam P. Cronehim, is to be reopened and operated by M. D. MacRae and associates. This North Carolina group also plans to take over several other mica mines in the region.

★Dixie Mining Co. will operate the **Battle mine** at Culoden.

★Arthur T. Anderson of College Park plans to operate the **Carter mine** located in Upson County near Thomaston.

IDAHO

★Two new deep-level crosscuts toward the fault-vein structure in the property of Silver Syndicate, Inc., in the silver belt of the Coeur d'Alene mining district are currently in progress. They are being driven by **Sunshine Mining Co.** from the lower level workings of its adjoining property under a profit-sharing agreement.

One is an exploration crosscut from the 3700-ft. level of the No. 4 shaft aimed at intersecting the vein near the center of a 2000-ft. segment of virtually unexplored ground between t e East and West Rambo areas of the vein, both of which are now yielding silver-lead ore.

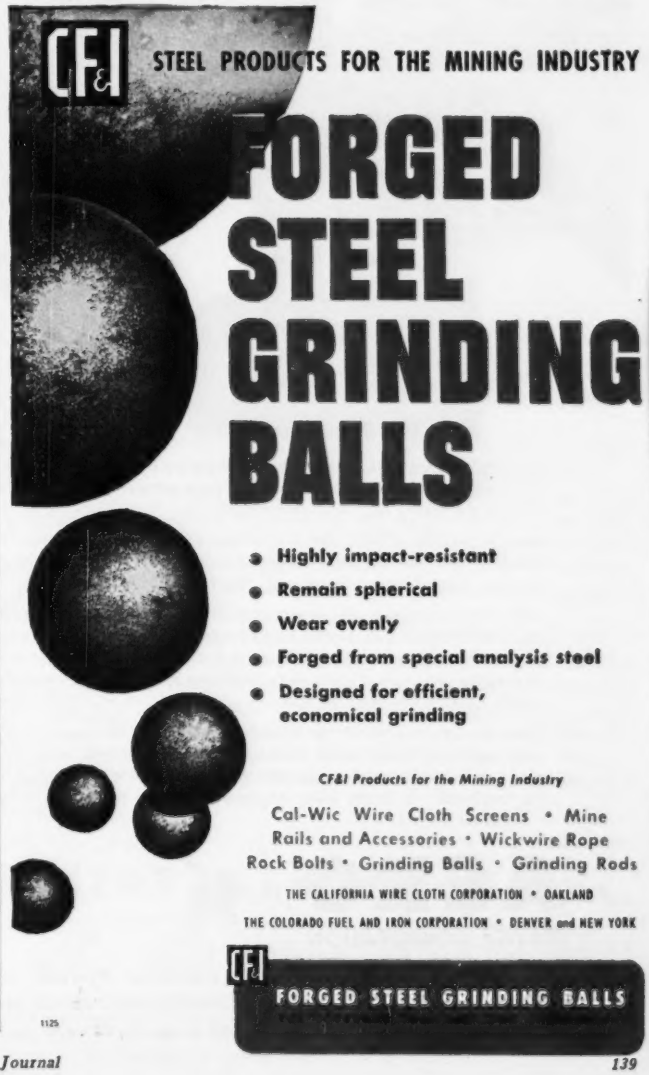
The other is a development crosscut from the 2700-ft. level of the main Jewell shaft. It will open the vein at a point approximately above the No. 70 stope in the west Rambo area and provide an opening with which raise and stope work above the 3100-ft. level can connect.

Ore was first discovered in the **Silver Syndicate fault** on the 3700-ft. level. It has since been developed downward to the 3840-ft. level and upward to the 3100-ft. level. The new 2700-ft.-level work continues the upward search for commercial mineralization in this "upside-down" development.

★**An agreement providing deep-level exploration** of Hunter Creek Mining Co. property in the Hunter district of the Coeur d'Alene mining district from the adjoining Lucky Friday Silver-Lead Mines property has recently been concluded.

The exploration work will be done from the 2000-ft. level of the Lucky Friday shaft to explore the "Star" vein which was last opened on the 1400-ft. level under a previous agreement between the two companies. The project will be carried on under the direction and supervision of Lucky Friday, and costs will be shared equally.

The agreement grants to Lucky Friday an additional quarter-interest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Idaho *(Continued)*

in Hunter Creek, so that ownership of the ground is now divided equally between the two firms.

★The Lakeview area of the Pend Oreille mining district in Bonner County is currently experiencing a modest revival of mining activity.

Idaho Lakeview Mining Co. is producing 40 to 50 tons of ore daily from the old Hewer and Keep Cool properties, both of which yielded substantial production from surface workings to early-day operators. At the Weber mine, another early-day producer, R. B. Austin, Spokane mining engineer, is mining by open-pit methods a big deposit of low-grade silver-gold-silica ore which can be shipped direct to the smelter because of its silica content.

Old lower workings of the Weber property are being reopened for further exploration by **New Rainbow Mining Co.** under a sublease. The other development project is at the old Conjecture mine, where Donald Majer and Lyle Funnell, Spokane businessmen, are carrying on a $53,228 mineral exploration program approved by the Defense Minerals Exploration Administration.

★**Idaho Custer Mines, Inc.**, has completed milling the dump material which its concentrator has been running for the past year at the old Livingston mine in Custer County. Since mid-August the mill has been treating mine ore. The mine is now completely re-equipped, and about 100,000 tons of ore have been blocked out above the main level, say officials.

★**Elmer Enderlin and Henry Connolly** of Kellogg have opened a 7-ft. width of zinc and tungsten ore in the first vein objective of their $9140, DMEA-approved, exploration project at the Meadowview claims near Fourth of July Lake in Custer County. A second vein, some 80 ft. beyond the first, remains to be opened.

★**Idaho Goldfields, Inc.**, has started work on a program of shaft-deepening and lower-level exploration at its property west of the Coeur d'Alene district between Kellogg and Coeur d'Alene. Sinking will be done both in the main shaft and on the galena ore exposed last year, just below the floor of the main adit tunnel.

★**Signal Mining Co.** has suspended milling and shipping and will stockpile production from the old Hilarity property on Pine creek until metal prices improve.

★**Defense Metals, Inc.**, has commenced work on a thorium and uranium exploration project at its Wonder property in Lemhi County, south of Salmon. Work will include surface trenching, diamond-drilling and drifting on a radioactive structure exposed in an old tunnel on the property. DMEA has approved expenditure of $68,265 on the project and will put up 90% of the funds.

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Idaho *(Continued)*

★A new orebody first opened by **Sunshine Mining Co.** late last year in the Omega area of its property in the silver belt of the Coeur d'Alene district is developing into an important additional ore reserve for Sunshine and Polaris Mining Co., which shares production in this area. On the 3400-ft. level where it was first opened, over 200 ft. of 90-oz. silver ore 4 ft. wide has been exposed. Drift work now in progress on the 3700-ft. level is also in excellent ore. Indications are that the shoot will extend a considerable distance below this level. The vein in which the ore was found is believed to be the downward extension of the vein system which the Polaris firm mined down to its 2300 level. This level of the Polaris workings corresponds with the 1300-ft. level of the Sunshine mine.

★Geophysical tests conducted by **Sunrise Mining Co.** this summer have disclosed a large mineralized vein transversing its property, which is located about a mile north of the Sunshine mine. Diamond-drilling of the structure is planned.

★**Lucky Friday Silver-Lead Mines Co.** is now sinking a three-compartment offset winze from the 2000-ft. level of its mine east of Mullan. It is being sunk about 300 ft. south of the main shaft, within about 200 ft. of the Lucky Friday vein. Present plans call for 200 ft. of sinking and establishment of a new 2200-ft. level.

Arrangements have been concluded between **Lookout Mountain Mining and Milling Co. and Sunset Mineral, Inc.,** for deep-level exploration of Lookout property on Pine creek from Sunset's adjoining lower workings. Now under way is a southerly crosscut from the 1200-ft. level of the Sunset shaft. It is expected to intersect three known veins within 1800 ft., the final one being the Lookout vein which has yielded extremely high-grade lead ore in small amounts from upper workings. The new crosscut will gain about 1400 ft. of depth on old workings.

★**Western Consolidated Mines, Inc.** is reopening the old Ophir mine in the Rocky Bar area of south central Idaho and hopes to have it back in production soon. New exploration work in reopened workings has shown encouraging results, and a 100-ton flotation mill has already been installed.

MICHIGAN

★**Lake Superior Mining Institute, organized in 1893 at Iron Mountain, is to be disbanded.** The Institute's Council unanimously adopted a resolution to dispose of its remaining assets by contributing them to the Greater University Fund, University of Minnesota, for undergraduate scholarships in the School of Mines, and to the

Alumni Foundation of the Michigan College of Mining & Technology for the Memorial Union.

Once an influential organization, the Institute had been inactive since its last field meeting was held on the Menominee Range in 1939. The objectives for which it had been created were gradually absorbed by other, more active bodies. Members voted to distribute total assets of $10,330.82 in cash to the Greater University Fund and the balance to the Michigan College fund. LSMI's archives will be deposited with the Marquette (Mich.) County Historical Society.

★**All-rail shipment of iron ore** began in the Iron River district on Aug. 1 and was soon in full swing. A special pool of 8,000 to 10,000 gondolas is being set up by the Association of American Railroads to handle what will be a record all-rail ore movement. Shipments from the different ranges, including the Mesabi, are converged at the North Western R.R. Butler yard in Milwaukee. Although the cost of all-rail ore is from $1.75 to $2.00 more than that shipped by the Great Lakes, the urgent necessity of shipping every possible ton before winter weather arrives to slow down ore handling makes this of minor importance.

All rail ore shipments began late in the summer of 1950, and about 2-million tons were shipped that year. In 1951, 7,918,00 tons, or about 130,000 carloads, went all rail. Present loadings average from 600 to 750 cars a day.

MINNESOTA

★**The Lake Superior Iron Ore Association** announced that ore vessels on the Great Lakes for the week ended Aug. 16 established a new record by hauling 3,280,094 tons of iron ore. The previous weekly record of 3,258,328 tons was made in Aug., 1943. The additional new and larger ore boats of the fleet and the high water level prevailing in the lakes make still better records possible as the season progresses.

Total 1952 shipments as of August 16 were 31,316,288 tons compared to 53,131,894 tons for the corresponding date in 1951—a reduction of more than 41%, which cannot be made up.

★**Pioneer Mining Co.** has taken over the plant and equipment of the Stanley Mining Co., which had operated the Mary Ellen mine at Biwabik. The Stanley Mining Co. ended on Dec. 31, 1951, when its ore reserves were exhausted. The Pioneer Mining Co., has acquired new reserves near the Mary Ellen and will continue to produce a high-grade concentrate.

★The Lind-Greenway mine of **Jones & Laughlin Steel Corp.'s Minnesota Ore Division** is composed of the old Greenway—first opened in 1940—on the west side of the Prairie River, and the Lind on the east side. The concentration plant will be located on

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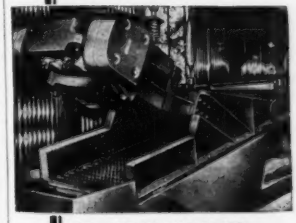

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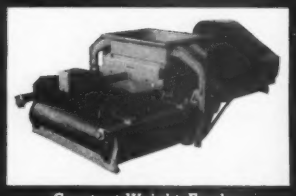
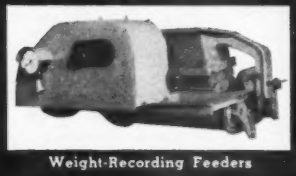
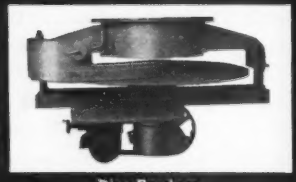


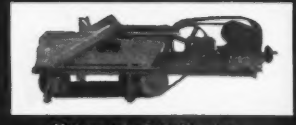
Constant-Weight Feeders



Weight-Recording Feeders



Disc Feeders



Volumetric Belt Feeders

CONSTANT-WEIGHT FEEDERS regulate the feeding of materials at a **constant-weight** rate, rather than a constant-volume rate The feeder automatically compensates for changes in specific gravity and bulking, due to moisture, which would cause irregular feeding.

WEIGHT-RECORDING FEEDERS keep a record of the amount of material fed. Feeder is the constant-weight type equipped with recorder.

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COMPLETE DATA on Hardinge Feeders available in Bulletin 33-D-1 Get your copy today.

See Opposite Page for Addresses of District Offices

H A R D I N G E

Minnesota *(Continued)*

the Greenway, and Lind ore will be trucked to it over a bridge. Stripping at the Lind will begin in the near future.

★The St. James mine at Aurora, now operated by **Oglebay, Norton & Co.**, reentered the shipping list this spring after 28 years. Previous to 1952, it had shipped a total of 2,680,830 tons from underground with an estimated 4,482,377 tons remaining. Last shipment, of 519,210 tons, was made in 1924. The present open pit mine is newly equipped with electric shovel, trucks, and belt conveyor.

★**The Manganese Chemicals Corp.** has announced that construction will begin in September on a $2-million pilot plant to recover manganese from low-grade ores on the Cuyuna Range. The plant will be built near Riverton and completed in about one year. The government has agreed to advance $1.5-million of the cost and to purchase any manganese that cannot be marketed elsewhere for the plant's first six years of operation.

An experimental plant will be opened about Sept. 15 at Fort Snelling, Minn., for treating low grade manganese ores. It will be operated by the U. S. Bureau of Mines and the University of Minnesota School of Mines.

Manganese Chemicals Corp. has patented a process which will be employed at the Riverton plant and which, it hopes, will be successful on a commercial basis.

★On August 18, **permits to prospect for iron ore** on 58 mining properties in northern Minnesota were granted by the State Executive Council. E. L. Palarine of St. Paul was the high bidder on the Grant mine at Buhl, formerly operated by the Interstate Iron Co., which shipped a total of 10,863,-591 tons from the property. The Grant is estimated to have a known reserve of about 700,000 tons in addition to more than 1-million tons of lean ore and paint rock and about the same amount of taconite in stockpiles.

Ray D. Nolan, director of the State Lands and Minerals Division, said that further exploration may develop an additional tonnage of reserve ore. He estimated that the ore, when shipped, will bring a royalty of from $2.26 to $2.86 per ton from this state lease. This is said to be a record high for Minnesota royalty payments. Some old leases are still operating on a 12½¢ royalty.

Other permits were issued to: Hanna Coal and Ore Corp., Hibbing, 14, seven of which cover unexplored properties which are highly magnetic and are about 16 mi. north of Nashwalk; Cleveland Cliffs Iron Co., Hibbing, 11, seven of which are on the Vermillion Range; Erie Mining Co., Cleveland, 8, all on the eastern Mesabi; W. S. Moore Co., Duluth, 8, all on the Mesabi and one covering the Bruce Annex mine near Chisholm;

Ontario Iron Co., Cleveland, 5, including the former Yates mine and adjacent forties near Kinney (last shipment from the Yates was in 1909); R. Maturi Corp., Chisholm, 4, three of which are on lean ore stockpiles totaling 116,000 tons; Campbell Mining Co., Cleveland, 2; Rhude & Fryberger, 2, covering the Sullivan No. 2 (formerly operated by Interstate Iron Co.) and an undeveloped unit; and Cashen-Erickson, Inc., Virginia, Iron Range Mining Co., Cleveland, and E. A. Young, Inc., Hibbing, one each. A total of 140 bids was submitted covering 73 mining units.

★Work on **Reserve Mining Co.'s Beaver Bay taconite development** is progressing. The breakwater is rapidly taking shape. Offices and barracks are being erected as are buildings for the power plant, workshops and warehouse. Fifty houses have been moved in from Crystal Bay for employee occupation.

★A new ore carrier which joined the lake fleet after the strike is the Johnstown of the **Bethlehem Transportation Corp.** She will carry "in excess of 15,000 tons."

MONTANA

★W. R. Wade and H. G. Obendorf of Marysville, have started work on a tungsten deposit at Marysville showing **several beds of good scheelite ore.** A bulk sample from an outcrop assaying 4.7% WO_3 is being run for metallurgical and concentrating tests. The preliminary test work has indicated that a plus-60%-grade concentrate can be made by gravity methods. This discovery is near the old Drumlummon mine, which has a production record of $23-million in gold and silver. The Drumlummon mine has been operated during the past several years by W. R. Wade under the name of Montana Rainbow Mining Co., during which time $1,080,000 was produced.

★**E. G. Smith,** Osborn, Idaho, former lessee of the Nancy Lee mine, is now operating the old Iron Mountain mine at Flat Creek, about 3 mi. north of Superior. The Iron Mountain is opened by a 5600-ft. tunnel and a 2200-ft. shaft. Mr. Smith is producing about 60 tons of zinc-lead-silver ore per day, which is being concentrated at the Nancy Lee mill.

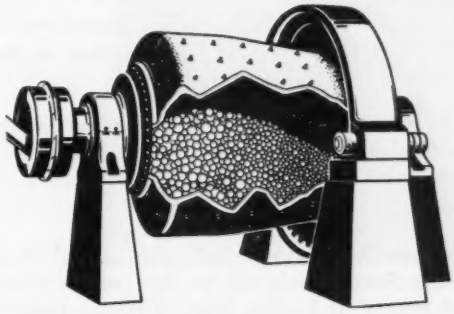
★**U. S. Steel Co.** is reported to have taken a 99-year lease and option on 11 fluorspar claims in southeastern Ravalli County, with an advance royalty payment of $100,000. The ore is said to be high grade and will bring $7.50 per ton, fob cars at Darby.

★At the August meeting of the Montana Board of Education, **Dr. J. R. Van Pelt,** president of the Montana Bureau of Mines & Geology, was authorized to seek the services of a state geologist especially to handle the problems of state petroleum lands and general mineral developments.

IS

GRINDING CAPACITY

YOUR PROBLEM?



HARDINGE TRICONE MILLS

The Hardinge Tricone Mill is ideal for large tonnages because of its design. The tapered barrel causes correct ball alignment, conserving grinding energy. The Tricone Mill occupies less floor space for a given grinding volume than any other mill ever built and overall power consumption is reduced 5% by new design bearings. A grate may be added when more capacity is required but the wear of balls is minimized because only small balls come in contact with the grate. Bulletin AH-414-1.

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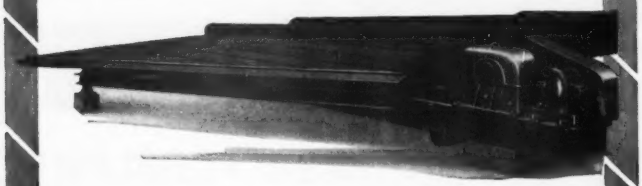
SuperDuty Keeps Cost of Concentration Down



The production of high grade concentrates is most profitable when your job is handled by the SuperDuty Diagonal Deck Table.

Its treatment of minerals is exceptionally efficient, due to sharpest separations and the fanning out of the material bed for most accurate cutting of products.

The SuperDuty is furnished with special Pool Riffling Systems, selected for the sand or slime feed treated. It handles from 10 to 250 tons of feed per 24 hours, depending upon character of the ore and operating considerations.

For full information, ask for Bulletin 118B.

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NEVADA

★**Homestake Mining Co., and Summit King Mines** have discovered promising gold and silver ore in **Tonopah**, by diamond drilling on property leased from Calumet & Hecla. Under present arrangements, the share in production would break down to about 40% for Calumet & Hecla and 30% each for Homestake and Summit King. The last named is a subsidiary of the Bralorne Mining Co. of British Columbia. If current development continues to bring favorable results, it is planned to move the 70-ton cyanide treatment plant from the Summit King mine at Fallon to Tonopah.

★**Scheelite ore** with a reported value approaching $600 per ton has been uncovered in the Shafer mine near Cherry Creek, White Pine County, by the **Baltimore-Cames Co.** According to G. P. Williams, president, the ore has a 10% tungsten content, and the vein varies in width from 18 in. to 2 ft. It has been followed for more than 20 ft.

★**The Baltimore-Cames Co.** has installed a tungsten concentration plant at Lackawanna Springs near Ely. It can handle 100 tons of custom ore daily from properties in the area in addition to treating the output of the company's own mines.

★**The Cordero mercury mine** in Humboldt County, which was a big producer during the last war, is again in first place in mercury production in the United States. The Cordero ceased operations for a few years after the end of hostilities but resumed work several months ago due to the increased demand for mercury.

★**Big Creek Mining and Milling Co.** has sold the old Clifton mill near Austin to the Nevada Equity Co. The sale included adjoining mining property known as Clifton No. 1 and Clifton No. 2. The new owners are preparing the mill for operations which were discontinued 15 years ago. It will handle ore from the Big Creek antimony mine, which has been operated by the Nevada Equity Co. for the last 17 years, but which heretofore has shipped its ores elsewhere for treatment.

★**Additional heavy equipment** has arrived at Anaconda Copper Co.'s new development near Yerington and is being put into operation. Latest addition was a churn drill which has already been put to work in the large-scale open pit development. The new townsite at the Yerington development is named Weed Heights, in honor of the Anaconda vice president.

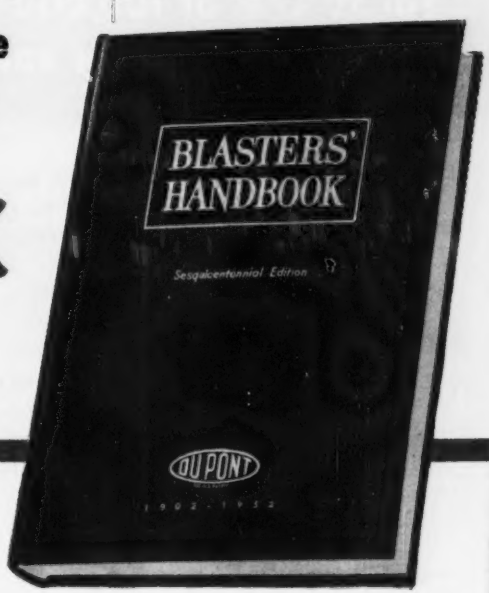
★**Last Chance Co.** is employing 18 men at its antimony mine and smelter in the Wall Canyon area of Nye County. According to Jarl Gibson, general manager, three men are working in the mine and 15 in the smelter, which uses an electrolytic treatment method.

DU PONT ANNOUNCES

The Sesquicentennial Edition of the

BLASTERS' HANDBOOK

COMPLETELY REVISED... COMPLETELY UP TO DATE!



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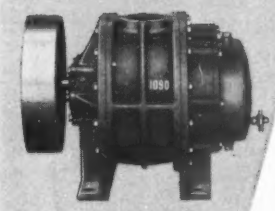
ROTARY



Typical low-capacity R-C Rotary Positive Blower. Sizes range from 5 cfm to 50,000 cfm, permitting selection closely matched to needs.

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- ☐ Capacity matched to the job
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For instance, if you're debating between Rotary Positives and Centrifugals, remember that only Roots-Connersville builds both—the exclusive *dual-ability line* that permits unbiased recommendations. Their wide range of capacities supplies sizes and types that are quite likely to be most closely matched to your needs.

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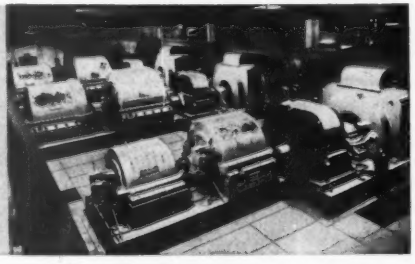


ROOTS-CONNERSVILLE BLOWER

BLOWER BUILDERS SINCE 1854

A DIVISION OF DRESSER INDUSTRIES, INC.

Nevada *(Continued)*

★**Mohawk mine** in the Red Mountain district of Nye County reports a strike of valuable gold and silver ore. E. R. Hines, manager of the property, says one crosscut shows the vein to be 40 ft. wide with good values.

★**The Mohawk mill** at Silver Peak, owned by Avery Brundage, of Chicago, Ill., is currently operating on a one-shift basis treating 50 tons per day from the Nivloc mine. Using the flotation process, the mill has a capacity of 150 tons and expects to increase its output in the near future with ore from the McNamara mine. Five men are currently employed in the operation.

★**The Smith brothers** of Gabbs, doing business as Commodore Tungsten Mines, are producing 3 tons of tungsten ore daily from their New Year mine northwest of Round Mountain. Mining is by overhand method.

★**Large scale production** is starting at the Castle Mountain mine near Austin, following a long construction program. Donavin Miller, company general manager, is in Austin to direct operations. The drift to the old Castle shaft has been completed, and the eight men employed on the work are now stoping and hauling ore to the mill. Slim Gulock is in charge of milling operations and is handling custom ore from properties in the Austin area, as well as the output of the Castle Mountain mine.

NEW MEXICO

★**The Wage Stabilization Board** has approved a wage schedule for the Southwest Potash Co., of Carlsbad district, employing 198 workers in its new mine and refinery scheduled to begin partial operations in August or September. Minimum salaries for monthly paid employees in 24 classifications range from $200 for messenger-clerk to $425 for hoisting engineer. Hourly workers in 24 groups: $1.35 for plant utility men to $1.88 for plant and mine maintenance men.

The board also approved an average wage increase of 3.8¢ an hour for 154 employees of the Anaconda Copper Mining Co. at its uranium concentrates mine and mill to be built at Grants. The increase will eliminate inequities between the company's Montana and New Mexico scales.

★**The International Association of Machinists** has filed charges of unfair labor practices against four potash mining companies in the Carlsbad district, accusing them of illegal aid and assistance to the United Mine Workers union, which it labeled a "company-dominated union." The four plants, United States Potash Co., Potash Company of America, International Minerals & Chemical Corp., and Duval Potash & Sulphur Co., are operating without union contracts. The Inter-

national Union of Mine, Mill & Smelter Workers' contract with Duval, expired early last summer.

★**Under a grant from the Geological Society of America,** Victor C. Allen expects to make a study of hedenbergite, a calcium-iron silicate known to miners as pyroxene, in his St. Louis laboratory, using New Mexican samples. He hopes to obtain some useful knowledge about the substance, if only as an index in locating ore deposits.

★Some 5,000 sq. mi. of mineral country in New Mexico was studied and mapped by advanced students from nine major American universities last summer under a field assistance fellowship agreement with the state Bureau of Mines and Mineral Resources. The plan permits the students to complete studies for their doctorates under professional guidance.

NORTH CAROLINA

★**American Vermiculite Co.,** Spruce Pine, plans construction of a processing plant in Woodruff. The vermiculite has been mined in the Enoree and Waldrop Cross Road sections for some time.

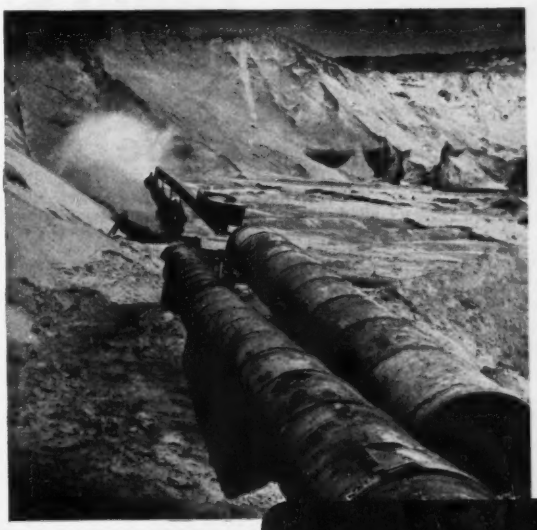
★Jointly-owned **New Dale Mica Co.** and **Carolina Mica Co.** of Kona have signed a contract with the United Textile Workers of America, AFL, providing for an average wage increase of 9¢ for approximately 130 workers, miners, and feldspar and mica processors. The wage increases range from 7 to 18½¢ per hour and raise the minimum wage from 94½¢ to $1.03.

★A new vein of high quality ruby mica has been discovered at the old Isom mica mine in the Cattail Creek section, 17 mi. from Burnsville, following the draining of the old shaft. Drilling of a 475-ft. tunnel permitted renewal of operations on the old vein and discovery of the new one. The tunnel was driven by Joe Godfrey, Yates Bennett and Mark Bennett, all of Burnsville, who are selling considerable quantities of high-quality mica to the government. A 1,456-lb. chunk of ruby mica taken from the mine is reported to be the largest ever obtained in any mine in the U. S. The new vein was discovered running parallel to the old vein separated by a thin layer of slate containing huge quantities of the highly colored ruby mica embedded in a superior feldspar.

OREGON

★**The U. S. Bureau of Mines** is testing nickel-bearing ground in the Red Flats area 19 mi. up Hunter's Creek Road from Gold Beach, covering some 4,000 acres. Mineral rights to the area are held by Mrs. Smedberg and Harry

Familiar Scenes
IN MINING SERVICE



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The extra strength and safety made possible by the exclusive Naylor Lockseam Spiralweld structure makes Naylor light-weight pipe the answer for high pressure hydraulic lines. Light weight, ease of handling and installation, and high-speed assembly with Naylor Wedge-Lock couplings are other reasons why you see so much Naylor Pipe in mining service.

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In furnaces of all kinds, where basic slags are employed, RITEX withstands conditions that would destroy other types of refractories in a short time—provides service that is often measured in months or years, instead of in days or weeks. No other product can match RITEX for toughness under fire in so many industries. RITEX speeded, in great measure, our rapid victory of World War II.

RITEX is world famous for spectacular increases in production of steel, brass and copper . . . for severe service in cement kilns, paper plant recovery furnaces, glass tank checkers and regenerators. RITEX has no equal!

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RITEX brick are made of high grade magnesite and chrome ores, combined in the proportion needed for best service in each type of furnace. Exclusive RITEX features are its combination of scientific grain sizing, high forming pressure, and patented highly refractory chemical bonds.

It is "tops" in resistance to a combination of shrinkage, spalling, slag corrosion, load and abrasion—offers minimum heat loss through the lining. For service too tough for any other product—and for major savings in many operations—depend on Grefco's exclusive RITEX.

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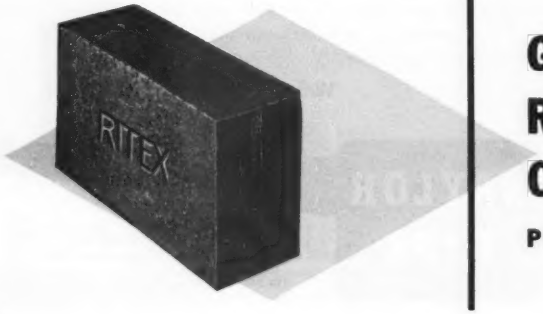

GENERAL REFRACTORIES COMPANY

PHILADELPHIA

Oregon *(Continued)*

Hedderly, Gold Beach; A. L. La Chance, Agness; Joseph McKeown, Coos Bay, and John A. Walsh & Associates, Coos Bay. Testing is under supervision of John McWilliams, engineer for the bureau.

★**The 110 tons of chrome ore** milled from the Dry Camp mine by Bert Hayes, John Day, Ore., produced 55 tons of concentrates which he shipped by truck to the government depot at Grants Pass. The concentrates assayed nearly 48% Cr_2O_3 and had a chrome-iron ratio of about 2.6 to 1. . . . A new chrome concentrating mill just east of the town of John Day, has shipped 9 tons of concentrates to the Grants Pass depot with another 9 tons ready to ship. Mill feed is from the Potato Patch mine near John Day. . . . **A mill built on the Eagle property** north of Bandon, Coos County, by Paul Littell and J. S. McKee together with the Idaho Canadian Dredging Co., will treat the black sand deposit which occurs in the Eagle and adjoining Pioneer mine areas. The mill includes 14 tables, and a magnetic separator will be added. George Murphy is in charge of operations. Gold, platinum, chromite, magnetite, ilmenite, garnet, zircon, and monazite fractions reportedly will be obtained. . . . The chrome concentrating mill being built by Paul Littell and J. S. McKee at the old granite quarry, Grants Pass, includes a jaw crusher, hammer mill, and two tables, with a third to be added. Ore will be hauled from the Black Bird mine near the mouth of Swede Creek, leased from Pete Neubert, Grants Pass. Capacity is said to be about 50 tons a day. . . . **Chromite is being sorted** from slide material near the old Nigger mine portal in Josephine County by Lew Robertson, using a bulldozer and two men to sort out chromite boulders from the slide material, averaging about two tons of chrome per day. Exploration is being conducted in the tunnel of the mine and near the top of the ridge above and west of the mine tunnel. Robertson is also prospecting on several other claims.

TENNESSEE

★**Tennessee Copper Co.** has adopted a plan to pay the cost of monthly premiums to provide prepaid group hospital and surgical insurance for employees. The new arrangement supersedes the present plan by which employees pay the premiums.

UTAH

★**Strained labor relations** in Utah's copper industry abated with agreement on a temporary contract extension between the United Steelworkers Local 4347 and Kennecott.

According to S. Lyle Johnson, fed-

COTTON
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We are specialists in woven filter media for industrial filtration both in media design and application. This specialization goes back almost to the beginning of this century when our organization was founded and has been continuously maintained ever since.

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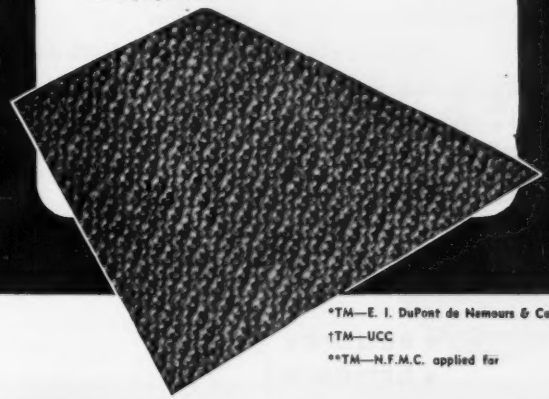

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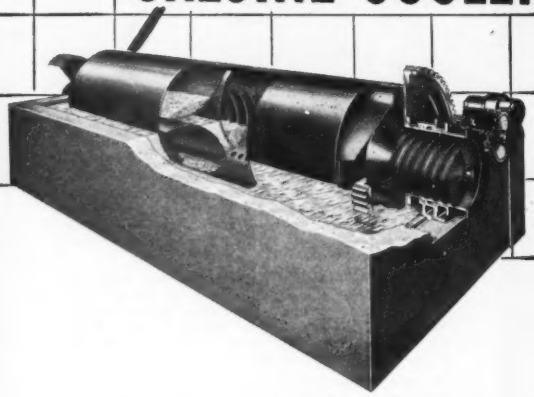

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Utah *(Continued)*

eral mediation commissioner, the old contract covering 700 Garfield refinery workers was extended on a day-to-day basis until Sept. 30, while company and union officials continued efforts to negotiate a new agreement.

While no details of increased wages and other provisions being sought by union negotiators have been released, Johnson said, "some progress is being made." However, members of the International Union of Mine, Mill and Smelter Workers were reported Sept. 2 to have voted "by a large majority" to strike all Kennecott properties in Utah, Nevada, Arizona and New Mexico if new wage contracts are not signed. There are upwards of 3,000 members at Bingham Canyon mine and related Utah operations.

Al Skinner, regional director of the union, noting that three of the "Big Four" copper companies have signed contracts, stated, "so far we haven't been able to reach any agreement with Kennecott." Up to late September, neither union nor management had reported reaching a conclusive agreement.

★**Silver King Coalition Mines Co.** closed its operations in the Park City district on Aug. 16, making a total of some 1,000 mine workers now idle in the lead-zinc-silver district. Several hundred men continued idle in mines of Eureka District.

As in the case of earlier shutdowns, the Silver King closing was ascribed to "the impact of economic conditions" and was based on a combination of falling metal prices and wage-contract demands.

Vice President and General Manager James Ivers reported some 180 men were directly affected by the Silver King shutdown.

★**Considerable surprise** was aroused in the state by entry of the Church of Jesus Christ of Latter Day Saints into the nonferrous metal mining business.

The Utah Mine Co. was organized in August and capitalized at $10,000 for business in Utah with offices in the headquarters of the Salt Lake City Mormon Church.

Church Apostles Henry D. Moyle and LeGrand Richards are president and vice president, respectively, with Joseph L. Wirthlin, presiding bishop of the church, secretary.

The corporation has been organized to hold unspecified lead-silver-zinc mining claims in Juab County "deeded to the church many years ago."

Historically, in the days of church leader Brigham Young, the Latter Day Saints bitterly fought the penetration of the mining industry into Utah. While the Church now has large holdings in such businesses as railroads, airlines, hotels, banking and real estate, the organization of the Utah Mine Co. is believed its first venture into a domain its leaders once bitterly criticized.

★**Park Utah Consolidated Mines Co.**

reported a $119,065 drop in income for the first half of 1952 as against the previous year's figures for the same period. Lower metal prices plus increased developmental and operating expenses were blamed for the sharp decline. Total ore sales were given at $1,092,886 for the half year.

★**Rumors of possible establishment of a copper fabricating plant** to utilize supplies from Kennecott Copper Corp.'s new Garfield electrolytic refinery have continued current in the Salt Lake area. Only solid facts available are that high Kennecott officials and some brass producers have termed establishment of such a facility feasible in time, and that Chamber of Commerce officials in Salt Lake City have made known the availability of adequate sites, power and labor.

One factor known to retard such construction is the freight rate structure prevailing in the region. However, high freight rates might be overcome by availability of West Coast markets.

★**The Atomic Energy Commission has announced** plans for the speedy establishment of an ore-buying and sampling plant near Greenriver, Utah, on the mainline of the Denver & Rio Grande Western RR.

AEC Chairman Gordon Dean stated the purpose of the new plant will be "stimulation of production of uranium ores in a 6,500-sq.-mi. area in the southeastern portion of Utah."

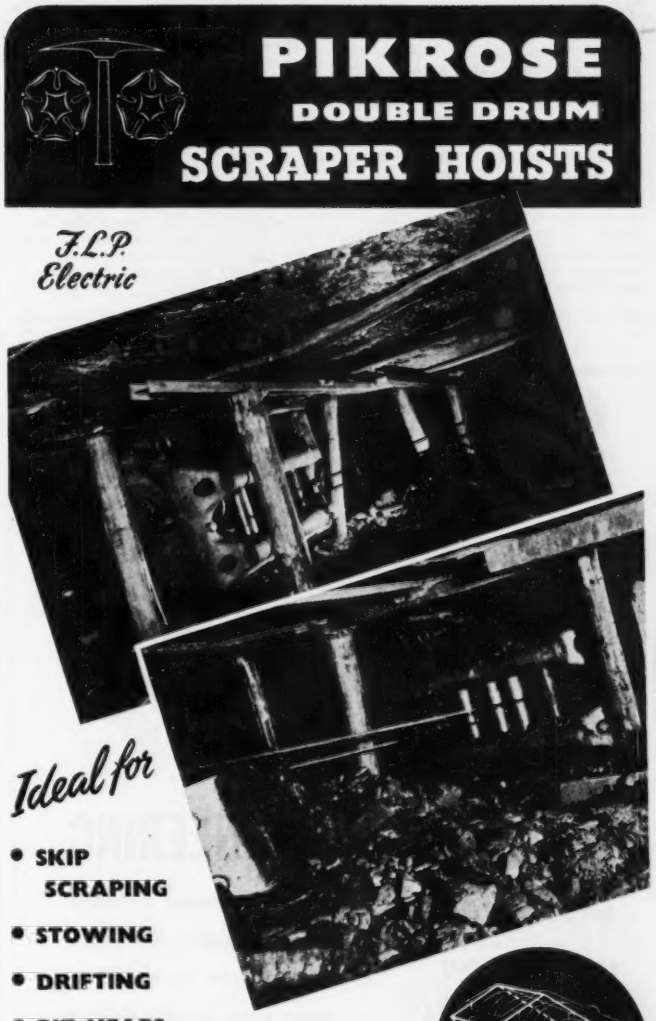
The plant is scheduled to have a sampling capacity of 200 tons of ore daily. Location will be on a 115-acre tract in Grand County just east of Greenriver.

Meantime, the AEC is sponsoring 18 access-road projects in southern Utah certified by the Department of Defense as being important to stimulating the production of uranium-bearing ores. Total cost of the access-road program is given at $2,361,000, with four additional projects to cost $105,000 recommended for approval by the Defense Department.

WASHINGTON

★A new one-year contract which will benefit 120 employees of **Spokane Portland Cement Co.'s** mill at Irvin and quarry at Northport was agreed upon in August. The working agreement revision will give a 15¢ increase per hour retroactive to July 1 for the employees, represented by United Cement, Lime & Gypsum Workers (AFL). Six paid holidays have been granted by the company. Last autumn pensions were granted voluntarily.

★Pend Oreille Mines & Metals Co.'s second 800-ton unit of the new concentrator has been operating on an around-the-clock basis since Aug. 12, W. L. Zeigler, manager, reported from Metaline Falls. The first unit has been operating at capacity, but the second may not reach capacity until the underground labor situation im-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proves. According to Mr. Zeigler the **supply of labor in that area is "critical."** He reported his company could use more than 100 production workers. The underground ore conveyor system with an addition of 1,200 ft. has been increased to about 2,850 ft.

★According to Frank Lilly, president of **Gold Bond Mining Co.**, a portion of the company's property in the Blewett district of the Cascades is being sampled for nickel and cobalt by a group which might be interested in leasing the property.

★Tungsten Mining & Milling Co. started testing low-grade surface talus in August with its 300-ton daily capacity mill at its Germania mine in Stevens County. Installation of machinery was started in March under an **RFC production loan of $50,000**, the first of its kind approved in the Northwest. Ten men on the property have the work well under way under the $34,650 DMEA exploration loan granted last winter. The main adit of the old mine has been cleared and 300 ft. of crosscutting has been done. The "North" vein has been opened by a tunnel, and drifting has been in ore for quite a distance with showings of both wolframite and scheelite.

★On property adjoining the Germania mine in Stevens County, the **Germania Consolidated Mines, Inc.**, has eight men at work in its mine and mill, where it has recently completed installing machinery to remove iron and sulphur impurities from its tungsten ore. Stockpiled concentrates from previous operations are going through a small ball mill and flotation cell to improve the grade of the product. A 300-ton drum of these concentrates was taken to Spokane for shipment. About a ton of coarser concentrates averaging between 69 and 72% tungsten has been shipped monthly by the company, according to E. I. Fisher, secretary-treasurer. Concentrates have gone to Kennametal, Inc., Latrobe, Pa., but the company has been asked to send future shipments to the new "Marco" plant at Port Coquitlam, B. C.

★**Columbia Tungsten Corp.**, holding 15 claims and fractions 18 mi. west of Addy, in Stevens County, has opened a wide tungsten deposit by running a 35 ft. surface trench across the vein system. The 20-ft. mineralized zone with 6 ft. of high-grade tungsten will average 3% tungsten content over the entire width, S. Harry Draper, president, estimated. Two parallel quartz veins 14 to 16 in. wide carrying tungsten values had been opened about 200 ft.

★**Pacific Northwest Mining Co.**, developing the Red Top and Lucille mines about 27 mi. southeast of Northport, has leased the Admiral mill about 2 mi. from the mines.

★Open pit mining has been under way for several months by **Springdale Silica Sand Co.** at Lyon's hill, 8 mi. west of Springdale. Silica sand being treated runs more than 99% pure silica.

★**Alder Gold-Copper Co.**, which shut down its mill near Twisp last winter because of severe weather, resumed operations Aug. 8. Production was to start with 250 tons daily and later be stepped up to 300 tons mill capacity. Crosscuts have been driven and raises blasted to upper levels of the mine in preparation for a modified type of block-caving mining. It was planned to use long-hole sectional drill steel. A diesel-electric power plant and water supply system were installed.

★In an inventory of the industrial and nonmetallic **minerals of the Pacific Northwest** released recently by the U. S. Bureau of Mines, Washington's production of such minerals and their products in recent years was listed as ranging between $24,000,000 and $31,500,000 annually.

★**Border Lord Mining Corp.**, after preliminary work at Four Metals mine near Nighthawk, where it believes there are major tungsten deposits, plans to move its crews from the high altitude Apex-Wolframite Mountain deposits when snow closes those workings to the Four Metals mine for winter work. It is reported that sampling has indicated ore of more than 1% WO_3 in abundance.

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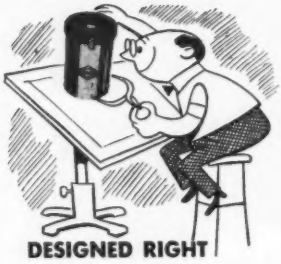

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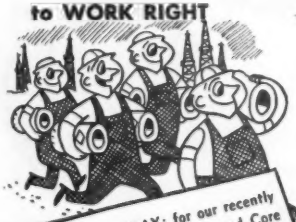

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★At midnight Sept. 3, Bonneville Power Administration **cut off 300,000 kw. of "interruptible" power** from the aluminum industry of the Northwest. The act was reported to be the result of falling stream flows and lack of sufficient water storage in the area. J. H. Lindemuth, manager at Kaiser's aluminum reduction plant at Mead, said two of the eight pot lines would be closed, and he estimated that 450 men would be out of employment. Officials of Alcoa's plant at Vancouver said between 16 and 20% of its aluminum output would be lost, and reports said the Reynold's plant at Troutdale would lose about 15% of its production as a result of the cutback.

★Pend Oreille Mines & Metals Co. confirmed the report Sept. 2 that Reeves MacDonald Mines, Ltd., would pay its **second dividend of 25¢ a share** on Oct. 10, with the disbursement amounting to $584,500.

★**Silver Mountain Mining Co.** expects to begin production of concentrates from gold, silver, lead, and zinc ore at its property near Tonasket upon completion of a concentrating plant early this month, according to D. H. Watts of Tacoma, company secretary. Watts is directing a six-man crew in construction of the 32x50-ft. mill building at the mine site. Some 5,000 tons of ore are ready for treatment, and the new mill will have an initial capacity of 250 tons per day and an eventual capacity of 500 tons. The concentrate will go to Kellogg, Ida.

★**Glacier Mining Co.** has received an exploration loan from the government on properties near Glacier. A proposed crosscut of 150 ft. is expected to prove copper-bearing potentials, according to R. B. LaFlamboy, president. Considerable development work has been done on the 240-acre property in the past few years.

IN CANADA

BRITISH COLUMBIA

★**Western Canada Steel Co.** at Vancouver is planning a $4-million electric furnace to be located near a British Columbia iron ore deposit, probably at Quinsam Lake, Vancouver Island, where the Argonaut Co., Utah Construction subsidiary, now is shipping ore to Japan and the United States. Billets from the furnace would be barged to Vancouver for conversion into bars, rods, shapes and other construction products.

★**Argonaut Co.** made its first shipment of Quinsam Lake iron ore to the United States in August when 10,250 tons went to Bethlehem Steel Co. at Baltimore. Contracts call for regular export to the United States at the rate of two shiploads a month.

★**Quatsino Copper Gold Mines, Ltd.,** operating on the west coast of Van-

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British Columbia *(Continued)*

couver Island, has located iron ore in a T shape running 1,250 ft. north and 1,400 ft. east and west, and reports enough ore has now been either proved or indicated to justify production expense. Work so far has established that the contact extends for at least 8,000 ft. across the company's property.

★**Cassiar Asbestos Corp.**, subsidiary of Conwest Exploration, plans limited production this fall at its McDame Creek mine in north central British Columbia, the province's first major asbestos mine. Hand-sorting already has been started, and a 250-ton mill is being built, with completion scheduled for next spring or summer.

★**The Mastodon mine**, near Revelstoke, revived by Mastodon Zinc Mines, Ltd., has gone into production with a $1.5-million, 150-ton mill. The mine was returned to production by Dr. Desmonth "Cap" Kidd and Golden Manitou Mines, which holds 51% of the stock in the company. Feature of the mine is a 42-ton tramway running up the mountainside at a 50-deg. angle.

★Tulsequah operations of **Consolidated Mining & Smelting Co.**, about 60 mi. east of Juneau, Alaska, will be expanded to a 500-ton daily rate by next January. At present, a $500,000 program is in progress to increase the capacity of the Polaris Taku concentrator, on which Cominco now has an eight-year lease. Concentrator at present is handling 300 tons daily from the Tulsequah Chief and Big Bull mines.

★**Giant Mascot Mines, Ltd.**, Spillimacheen, has increased its capacity to 450 tons of ore daily to become the second largest producer of lead concentrates in British Columbia. Since milling started in February 1951, the mine produced more than $1-million worth of lead.

★**Sheep Creek Gold Mines, Ltd.**, is continuing with expansion and exploration programs at its base metal properties despite lower metal prices and higher costs. Sheep Creek reports a net profit of $351,253 in the year ended May 31, compared with $406,212 the previous year. Income taxes were up $25,000. The Paradise mill, silver-lead-zinc producer near Invermere, is being increased to handle 75 tons daily and the Mineral King is being prepared for further development in the Golden mining division. Ore reserves have been increased at the Paradise mine by over 50%, and, at the Zincton base metal property in Slocan area, reserves are greater than when operations started 12 years ago.

★**Western Mines, Ltd.**, set a new record in July for tons of ore milled at the Ainsworth property. The Western mine supplied 2101 tons of silver-lead-zinc ore, and 301 tons additional came from leasing operations. Value of July production was $31,814. Western is milling almost double the tonnage rate in effect when the property was taken over less than a year ago. A stepped-up development program has been announced and the present 100-ton mill may be enlarged.

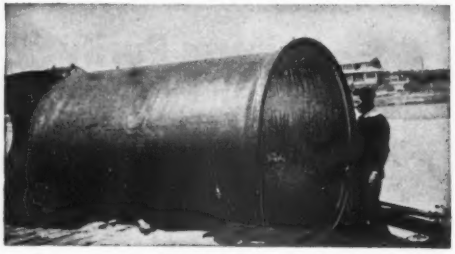
★Costs are running far ahead of original estimates in **Aluminium Co. of Canada's** big hydroelectric aluminum smelting project southeast of Prince Rupert in British Columbia, with Alcan spending to date an estimated $84.5-million in laying the groundwork for the development, scheduled to turn out ingots early in 1954. First stage is expected to cost about $200-million, compared to $160-million estimated earlier. Total cost is put at over $600-million, compared with the original figure of $500-million.

MANITOBA

★**Hudson Bay Mining & Smelting Co.** reports net earnings for the first six months of 1952 were approximately 9% above the corresponding period last year. Net was estimated at $8,275,366, or $3 per share. During the 1952 period, 780,544 tons was milled against 931,629 tons in the first half of 1951.

The company is carrying out diamond drilling on its claims near the town of Sherridon in northern Manitoba and also has three drills operating in southwestern Yukon exploring its newly acquired base metal prospect.

This is worth looking into



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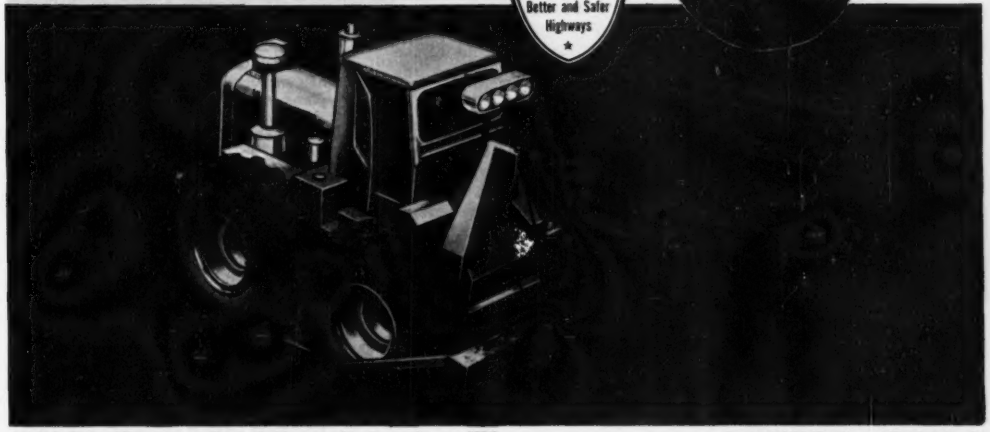

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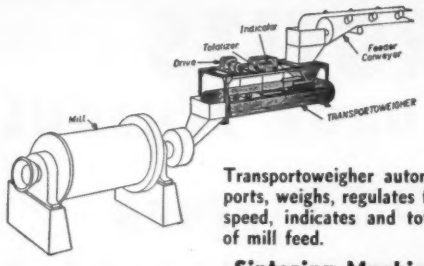

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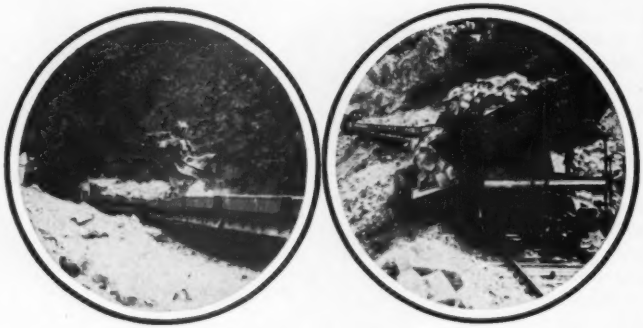

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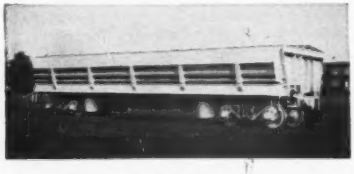

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SINCE 1915 — PIONEERS IN HAULAGE EQUIPMENT

Manitoba *(Continued)*

This latter showing has been reported as running 3.2% nickel, 2.2% copper, 0.14% cobalt and small amounts of precious metals, over a width of 48 ft.

★**Nor-Acme Gold Mines** reports royalties received for the year 1951 amounted to $51,214, compared with royalties of $67,289 for the previous year. The mine is controlled by Howe Sound Exploration Co. Since February of this year the royalty payments have been 3%, up from 2%, which prevailed during 1951, indicating treatment of a higher-grade ore.

ONTARIO

★In one of the major developments of Canadian mining during 1952, **Falconbridge Nickel Mines** has outlined more than 10-million tons of nickel-copper ore in its new orebody under **Fecunis** Lake.

The new ore adds 50% to the company's previously known reserves. Its grade is slightly better than the previous average of 1.74% nickel and 1% copper; and its volume would be sufficiently great to supply all the company's plants for 10 years at the 35-million lb. rate to which they are now being enlarged.

Fecunis Lake is on the northwest rim of the Sudbury basin, some 26 mi. from the original Falconbridge mine in a slightly northwest direction. It is in the same area as International Nickel's Levack mine and Falconbridge's new Hardy mine, where a shaft was sunk to 1,200 ft. last winter. It lengthens to 5 mi. the section of norite contact there along which ore has been found and promotes the northwest area of the basin to a place of major potential.

Falconbridge Nickel, controlled by Ventures, Ltd., now has five mines in production or under development. The original mine is still the main source of output, followed by the McKim, which is smaller and ships its ore to the Falconbridge concentrator by rail. At the Hardy mine underground work was started last winter, and thoughts are already being given to production plans, as well as to deepening of the shaft to 2,000 ft. At the same time the No. 8 shaft has been started on the east section of the original property (which means practically a new mine to be established there) and now the Fecunis has come along as the biggest single development in many years.

Current expansion plans will raise Falconbridge's output capacity by 50% over prewar levels. To finance them, the company has arranged to borrow up to $6-million from DMPA, which becomes its biggest single customer, and is raising $4.7-million from its shareholders by the issue of rights on new stock, one new share at $14 for each 10 shares held on Sept. 5.

★**Preston East Dome Mines** has been finding its best encouragement in years

lately as the west porphyry area is opened at depth. It is too early yet to quote specific dimensions or averages, but it looks as though both tonnage and grade of ore reserves will show a pleasing uplift when year-end calculations are made next winter.

Indicative of these results, production of this Porcupine area gold mine in July topped $200,000, compared with the monthly average of $190,000 recorded in 1951; output in the first half of August was at an even higher rate. (Holidays closed the mill for the latter half.) This increase, it should be pointed out, was made in the face of the declining gold price, which has dropped sharply with the change from premium to discount on U. S. funds.

★**Silver Miller Mines'** new cobalt concentrator, first of its kind in the Cobalt camp's long history, started operations last month. By an odd turn of events, it is built on the LaRose mine, which Silver-Miller now possesses. The LaRose was the scene of the area's original discovery by blacksmith Fred LaRose, who (according to the story) found a silver vein when he threw a hammer at a fox.

The new concentrator, with 150-ton capacity, is currently handling 100 tons daily, all from the LaRose mine, where cobalt ore was opened up in good quantity following the property's acquisition last year. The company has a sales agreement with the United States Government for up to 5-million lb. of cobalt metal.

★Shaft-sinking has been started on the Vermillion Lake section of **Ontario Pyrites Co.'s** big property in the Sudbury basin, where surface drilling outlined 1-million tons averaging 1.5% copper, 1% lead, 4.7% zinc, and 1.6 oz. of silver per ton. No underground work has previously been done on this section, which is 6 mi. west of the Errington mine where the old workings have been unwatered, and where drilling is in progress on three levels. The Vermillion shaft will have an initial depth of slightly more than 500 ft.

★**Lateral** work is getting under way on two levels at the property of **Coldstream Copper Mines**, revived copper-cobalt prospect 70 mi. west of Port Arthur in northwestern Ontario. The shaft has been completed to its initial depth of 350 ft., and levels are being established at 185 and 325 ft.

Nucleus of the property is the old Tip Top mine, which dates back to 1895, but which was closed for many years until the present company took it over some months ago.

QUEBEC

★**East Malartic Mines'** big deep orebody, already being opened up impressively on the 16th level, is now showing up well on the 15th with smaller dimensions but higher grade. Three flat holes drilled across it on the 15th level showed $13.87 across 50 ft.,

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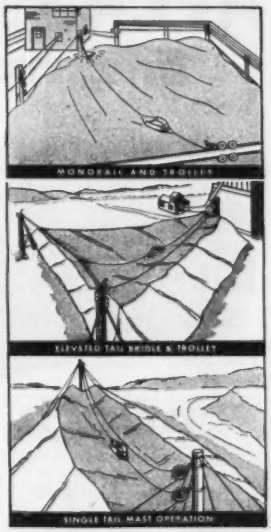

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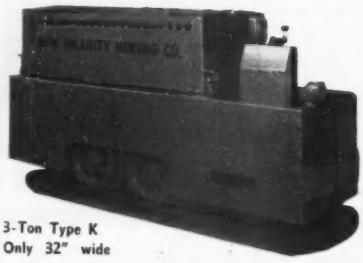

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Quebec *(Continued)*

$19.35 across 45 ft., and $14.28 across 60 ft. On the 16th level the first crosscut has gone through the ore and verifies the flat drilling with a width of 125 ft. and grade above $7 per ton. In the meantime shaft-deepening continues, with the opening now more than 100 ft. below the 16th (bottom) level. The new orebody is estimated to contain 3-million tons between the 14th and 17th levels, with average grade $8.10 per ton.

★One of the Noranda district's oldest prospects is to receive a new test, arrangements having been made for surface drilling on the property of West Wasa Mines. It's the old **Aldermac Copper Corp.** ground from which some $11-million in copper was produced prior to its closure in 1943. An initial $200,000 has been provided by a syndicate headed by Osisko Lake Mines, Ventures, and Frobisher.

★**Barvue Mines**, with largest starting tonnage rate of all new Canadian mines in the past two decades, initiates production this month. Capacity of the mill is in excess of 4,000 tons daily. A record has been made, too, by the speed with which production has been achieved. It is less than two years since the first ore intersection was drilled and only 15 months since financing was arranged to establish the open pit and build the concentrator. In Barraute Twp., Barvue is controlled by Golden Manitou Mines.

★**Rohault Mines** has started drilling on its 900-acre property in Rohault and Dauversiere Twps., Chibougamau area. The ground adjoins that of Chibougamau Explorers, Ltd., and it is believed that the latter's main zone extends into Rolette property.

★Another company drilling in Chibougamau is **Area Mines**, which in Hole No. 7 intersected 4.0 ft. averaging 12.98% copper, 3.11% zinc, and 3.79 oz. of silver per ton.

YUKON

★A new mining rush has erupted in the Yukon following discovery of an ore deposit reported to be rich in nickel and copper and carrying cobalt and platinum values. Hudson Bay Mining & Smelting Co. has taken an option and has rushed drilling crews by air from Flin Flin, Manitoba. Other major firms are reported investigating the area. Stakings extend over a 25-mi.-long area. Discovery, at Quill and Arch Creeks, near Kluane Lake, about 10 mi. from the Alaska Highway, was made by Yukon Mining Co. of Whitehorse, headed by Albert Coy. Values are reported to run as high as 2% copper and 3% nickel.

★Leonard Stampe, who shut down operations on Jack Wade in the Forty Mile district in 1951, is taking out placer on High Creek in the Mayo.

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IN LATIN AMERICA

BOLIVIA

★**President Victor Paz Estenssoro** has promised 70,000 workers that, despite opposition, nationalization of mines will go through. Speaking at a mass meeting called by the Bolivian Workers Union, he declared the government had been tolerant with its enemies and had granted ample liberties. But that attitude had been misunderstood by those who opposed nationalization, he said, and they had started to plan acts of terrorism.

"We are living in the most critical moments of the national revolution," said the President. "There are only 30 days left before the commission charged with studying nationalization of the mines makes its report. I can state that nationalization will be a fact by the end of that period, whatever obstacles may be raised either within or outside the country. That I promise you.

"We are going to nationalize the mines for two reasons, first, because we need their riches for the nation and, second, to take away control of those riches from Patino, Hochschild, and Aramayo."

The meeting decided to give complete support to the President on the nationalization issue. Patino, Hochschild and Aramayo are the three largest mining groups in Bolivia, accounting for the major part of the country's production.

CHILE

★**President - elect** Carlos Ibanez told a *New York Times* reporter he intends to pursue a policy which will bring maximum returns for Chile's raw materials without injuring the legitimate interests of foreign capital.

Mining men have been trying to forecast how they will be affected by election of Ibanez, who is known to have strong nationalistic sympathies.

Foreign enterprise in Chile must be free of colonial ambitions, Ibanez declared, and must be adapted to the conditions under which Chilean capital operates.

★According to official statistics released this month, a total of 18,968,099 kilos of **minerals valued at $1,979,484 were exported** from Guatemala in 1951. Of this total, the export of lead and zinc amounted to $1,900,000; the rest included marble and chrome ore.

All minerals are exported free of export tax.

According to authorities, the total mineral exports from this Republic may be substantially less this year due to lower lead prices in the U.S., increasing labor costs and a serious internal transportation problem, which is becoming progressively worse. As an example, they point out, Com-

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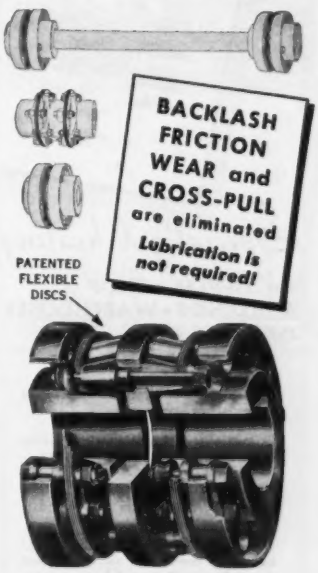

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Chile *(Continued)*

pañia Minera, S. A., a lead-zinc mine in north central Guatemala, reduced operations to an absolute minimum this year and employs fewer than one-third the number of miners it did last year. Compañia Minera is wholly owned by Hoover mining interests.

MEXICO

★Discovery of what may be one of the world's largest volcanic and almost pure sulphur deposits has been reported here by official sources. **Ninety-five per cent pure**, it is located in the crater of a volcanic hill 3,000 ft. high on Socorro Island in the Revilla Gigedo group, 370 mi. off the Pacific Coast.

Mr. Joseph Wekstein, who shares a federal reserve concession, said he expected the delivery of 1000 tons of ore and 200 tons of refined sulphur a day nine months after mining operations begin. A road 5 mi. long and loading facilities would have to be built.

Present production of sulphur in Mexico is less than 200 tons a day.

★**Mining exports** brought home 841,-700,000 pesos ($97,500,000) during the first half of 1952, announced the National Statistics Department. Top item was refined lead, 119,428 tons, worth 402.9-million pesos. Zinc was runner-up — 258,800,000 pesos, 94.5-million pesos for 23,456.2 tons of the refined metal and 164.3-million pesos for 162,-008 tons of concentrates. Copper exports were 19,735.8 tons of impure bars, 106.2-million pesos, and 8,456.5 tons of concentrates, 12.3 million pesos. Manganese shipments were 81,-677.5 tons worth 9-million pesos. Other major shipments were mercury, 170.6 tons, 6.6-million pesos; arsenic, 1,676.8 tons, 1.2-million pesos, and silver, 183,-140 kgs., 44,700,000 pesos. This trade yielded most money in May, 177.7-million pesos, but there was a decrease in June to 130.7-million pesos.

★Brazil is reportedly negotiating for **5,000 tons of Mexican sulphur** for $750,000. Aviation is to speed sulphur shipments from mines of the Neg. Minera Azufre, S.A., at Cerritos, San Luis Potosi. The company and the state government are building an airport at Cerritos. These mines and the plant of Petroleos Mexicanos, the official oil company, in the Poza Rica oil fields, Vera Cruz, now provide all Mexican sulphur. Petroleos revealed that the 3,500 tons of sulphur it had intended to sell Cuba was shipped to New Orleans instead because of a better price. As this consignment was moved on a Liberian freighter, reports were that its ultimate destination was Liberia.

★**The Cia. Minera La Azul, S.A.**, operating flourite properties at Acamixtla, Guerrero, resumed work after a strike that lasted from Dec. 20, 1950 to last May 10. Work resumption was ordered

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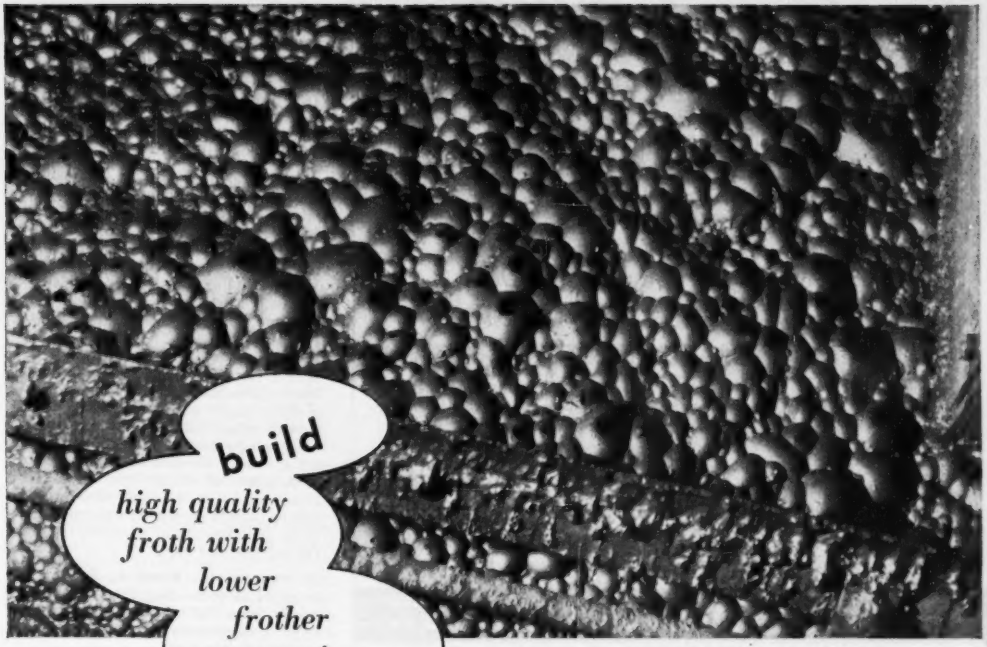

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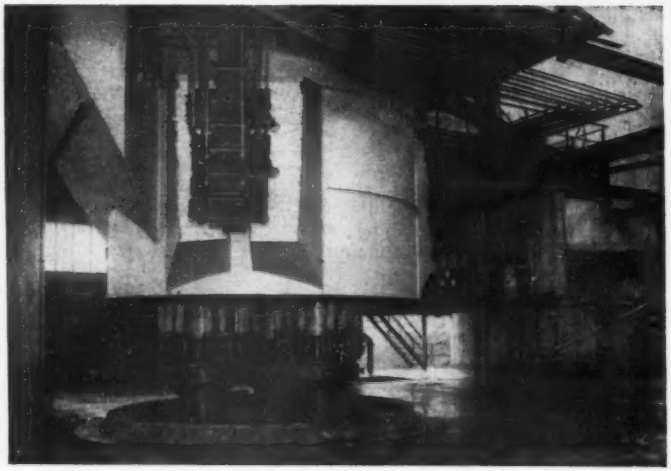

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Mexico *(Continued)*

by the Federal Board of Conciliation and Arbitration. The board also ordered La Azul to pay 261,706.15 pesos ($31,500) as wages during the strike, 56,173.14 pesos ($6,500) as strike costs and to reinstate all workers it had before the strike.

★A presidential decree placed in charge of the National Mining Stimulation Commission for exploitation **Las Escobetas and El Iman iron ore** tracts with a total area of 220 acres in Puente de Ixtla Municipality, Morelos.

PERU

★Since April this year the **Cerro de Pasco Corp.** has been working an electrolytic plant with an output of 35 tons of refined zinc per day. It is operating a new 35-ton zinc refining plant using the electrothermic process. Whichever of these two processes turns out to be the most satisfactory will be used in successive enlargements up to the capacity of over 200 tons of refined zinc per day.

★**Companie des Mines de Huaron** is engaged in increasing its present capacity from 750 tons per day to 1500 tons. Concentrates of lead, zinc and copper are produced.

★**Minas de Milluacocha** is a new mining company that has started operation in the neighborhood of the Cercapuquio mines near Huancayo in Central Peru. This month it will start operating a selective flotation plant for lead-zinc. Capacity is 50 tons.

★**Minas de Cercapuquio** is driving a 4,000-meter tunnel, which will be used for developing ore about 500 ft. below their present lower workings. This mine is notable for the high cadmium content of its ores, producing zinc concentrates running 1.2% cadmium.

IN AFRICA

★**South Africa will begin its** first production from gold-bearing ores at West Rand Consolidated Mines towards the end of September. It is expected that in the initial stages the uranium recovered will be sold to the U. S. A. Two U. S. metallurgists, Messrs. H. M. Lindholm and A. Jones, have arrived in the Union to advise on the recovery of uranium from mine tailings under a scheme sponsored by the U. S. Atomic Energy Board. They expect to be in South Africa two years. Mr. Lindholm described the potentialities of the Rand mines as great.

★**Steps are being taken** to avert the loss of a shaft costing more than $2-million at the Free State Geduld gold mine. A vast underground cavern filled with water impinges on the shaft. The

water is exerting such pressure on the intervening rock that the walls are in danger of caving in.

A 30-ft.-thick concrete mat has been cast at the bottom of the shaft. Subsequently, long holes are being drilled through to the solid rock and cementation operations undertaken. Once these have been completed the sinking of the shaft will be continued. Similar caverns encountered in the West Wits lines were successfully contained.

★South Africa will begin to produce uranium next month and will be the **world's biggest uranium producer** when production is in full swing, Minister of Mines Johannes Viljoen said. He said uranium production would be almost as big an asset to the Union in the future as gold production had been in the past.

Addressing a National Party meeting in Mafeking, Mr. Viljoen said details of uranium production would be kept secret for the present.

South Africa had entered into a contract with Britain and America to dispose of the metal.

★Northern Rhodesian **copper mines continue to be troubled by coal shortages**, although the position is expected to improve with the expansion of the Wankie coal fields. According to the latest report of the Rhodesian Department of Forestry, cutting of wood fuel continues on an immense scale. Last year, 940,000 tons of wood were consumed, and more than 29,000 acres were clear-felled. Felling, originally regarded as a temporary measure, has now cleared 80,000 acres, greatly exceeding regeneration and planting. So far as underground timbering is concerned, a survey by the department has located about 700 sq. mi. of forest, which should last 15 years. It contains 30-million sq. ft. of saw logs.

★Because the larger **Rhodesian chrome producers** have declared more than 500,000 tons of chrome ore, which has been stockpiled since the end of the war, the value of Southern Rhodesia's mineral output in June was officially given as more than $11-million, although it was actually nearer $4-million. The stockpiling is the result of inadequate rail transport facilities, but up until now declared mineral outputs have been based on actual railings, which in the case of chrome during June was nearly 34,000 tons.

Asbestos production in the first half amounted to the record figure of 39,756 tons, valued at around $8.7-million.

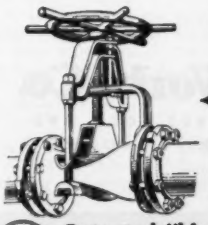
★**Johns-Manville**, which operates two asbestos mines in Canada, one of them the world's largest, announced plans today for immediate development in Africa of a third. The new ore properties are located at Mashaba in the Victoria District of Southern Rhodesia, about 200 mi. south of Salisbury and 120 mi. east of Bulawayo.

The project is part of Johns-Manville's long-range program to maintain adequate supplies of asbestos ore for many years to come, A. R. Fisher, president, said. Plans call for development of the asbestos ore properties of Rhodesian Asbestos, Ltd. and construction of a small central mill to process asbestos-bearing ore extracted from the mine, Fisher said. Rhodesian Asbestos, Ltd. was formed in December, 1951, and is under the direction of Canadian Johns-Manville Co., in association with British Metals Corp., Anglo-Huronian, Ltd., Southern Minerals & Marketing Corp., and the Simon I. Patino interests.

IN AUSTRALIA

★An intensive air and ground search for **uranium deposits** in Australia's Northern Territory is on. The Federal Bureau of Mineral Resources is in charge of the search, and U. S. experts are assisting. A specially fitted DC-3 plane is joining in the search, and, as soon as this plane registers something of interest, a small plane flying at tree-top height follows the initial exploration. Helicopters may be used in later stages of the search, and trained parties of geologists are being sent to selected spots in the territory. About 50,000 sq. mi. is considered well worth prospecting for uranium, and the search should be continued well into 1953. Highest reward offered to prospectors is about $60,000.

★Developments at **Rum Jungle** in the Northern Territory are less publicized, but it is known that diamond drilling is proceeding and that drill holes will be sunk to 500 ft. in various parts of the reef. The aim is to test the con-



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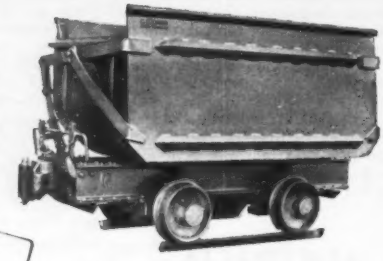

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Australia *(Continued)*

tinuance and depth of the lode. Northern Drillers Pty., Ltd. is doing the job.

★Permission has been given for the sale of fine gold of Australian origin on the premium market. Previously gold had to be processed before sales on the free market were allowed. About 20¢ will be added to the premium received by Australian gold producers on each oz. sold in free markets.

★One of Australia's largest mining companies, a member of the **Broken Hill group** associated with Zinc Corp., may construct a railway across Arnhem Land to exploit a rich zinc, lead and silver deposit. About $250,000 will be spent on preliminary work at Mainoru, 350 mi. southeast of Darwin.

★Preparations are proceeding vigorously for early production at Cudgen, a few miles south of Tweed Heads, by a company which claims that it would be the world's biggest producer of rutile sand. The company is **New South Wales Rutile Mining Co. Pty., Ltd.**, which some months ago took over operations of the Tweed Rutile Syndicate. Expected daily output will be 100 tons of rutile, 100 tons of zircon, and 50 tons of ilmenite. Most of the output will be sold to the United States. It is estimated the company's leases will cover 15 to 20 years' mining.

NEW SOUTH WALES

★Both the **Zinc Corp.** and its associate, **New Broken Hill Consolidated**, increased output in recent months. Lead, zinc and silver production registered increases, and assay values were also better. At Zinc Corp. ore assayed 14.6% lead, 11.9% zinc and 3.1% silver. New BH had a lead assay of 8.2%, zinc of 12.5% and silver of 1.9%.

★Wellington Alluvials, Ltd. has approximately 34 million yd. of digging with an estimated average content exceeding 3 grains/yd., but the shortest course to the profitable ground involved 10 months dredging at a loss. Close boring between original lines of bores for some distance upstream had been disappointing and would have seriously affected the company's future prospects. Last year dredge breakdowns and power restrictions reduced yardage to 2,218,000 (expected 3-million).

TASMANIA AND NORTHERN TERRITORY

★**Montana Silver Lead N. L.** expects to be in full production by November. The lode was going strongly underfoot on the 150 ft. level, and a new level would be opened up at 300 ft. Last year's net profit was £7327 compared with previous loss of £12,861. Production is sufficient to finance development and provide a small profit.

★**Peko (Tennant Creek) Gold Mines N. L.** reports copper values of up to 33% and of gold up to 55 oz. Ore in drive on the 300 ft. level is stated to be worth over $200 a ton. Average values are in the vicinity of 20 to 27% of copper and about 25 dwt. of gold.

★**Ajax Consolidated N. L.** reports that the original 3600 tons of probable ore has been proved, and an additional 3000 tons of probable ore is in sight at the Womobi tungsten mine. It is expected that at the end of 1952 about 15,000 tons of ore will be blocked out, with a similar tonnage of probable ore. The Granya battery is treating 26 tons a week, but this will be doubled. A treatment plant may be erected.

VICTORIA

★**Victoria's gold production** in the first six months of 1952 was 30,441 fine oz., 2627 fine oz. higher than the figure for the first half of last year, principally due to dredging activities at Amphitheatre and Harrietville.

After overcoming its technical difficulties at the Amphitheatre dredge, the Central Victoria Dredging Co. N. L. was reporting smooth work, and its net profit for the last financial year went up by about £6,000 to reach £48,026. The Jim Crow dredge treated 1.5-million cu. yd. for 7,764 fine oz., while the Amphitheatre dredge treated about 700,000 cu. yd. for 2,261 oz.

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PRESS NOSE TAPE IN CLOSE AGAINST FACE TO MOLD PAD AGAINST THE NOSTRILS
PRESS EDGES OF FACE PLATE DOWN TO FIT FACE SNUGLY

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MARTINDALE Protective Masks	$ .30 ea.
No. 1 Refills (standard weight)	.02 ea.
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Masks packed in individual envelopes.
Refills packed in envelopes containing 25.
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DISCOUNTS

Less than $10.00 list	Net
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$100.00 and over	20%
Minimum, charge account or C.O.D.	$2.00
Minimum, cash with order	$1.00

If payment accompanies order we will pay parcel post or express charges.

MARTINDALE ELECTRIC CO.
1378 HIRD AVE., CLEVELAND 7, OHIO

IN THE PHILIPPINES

★**Philippine gold miners have formed an association, "Gold Producers of the Philippines"**, to work for relief from the onerous tax policies of the government that are threatening the welfare of the industry. Confronted with rising costs and a continued decline in the open market for gold, quoted in August at the year's low of 102 pesos per ounce, gold mines are doing little more than trading dollars under present conditions. Because of the petition of the Chamber of Mines that immediate application of the Minimum Wage Law should be deferred for six months, it is expected that the mining industry may escape mandatory wage increases for the time being. Strong appeals are being made with officials of the Central Bank to repeal the provision of the law that requires 25% of the bullion output of every gold mine to be turned into the Treasury at 70 pesos ($35) per ounce, but without much hope of success. If the government agreed to forego its cut of the bullion, it would add about 10% to the total amount realized by the gold producers.

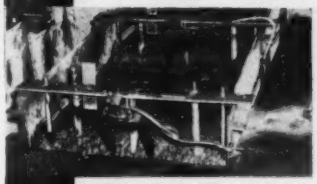
★**Resumption of mining at the old Hixbar copper mine** on Rapu-Rapu Island is proceeding under considerable difficulties. Most of the old mine workings are caved, with the ground in very bad condition. It is planned to open cut the ground above the first level as underground mining will be too dangerous. Stripping operations will soon begin. This should not interfere with mining by usual methods from the lower levels. The road to the mine has been restored for truck haulage and is now in good condition with three trucks in use. The first 1,100 tons of ore were loaded in June, averaging about 5% copper, and were consigned to Japanese smelters. About 100 men are employed. George Scholey, formerly with Nielson & Co. before the war, is in charge of the work. Paul A. Schafer is consulting geologist.

Hixbar has under consideration a contract with the National Power Corp. to supply the latter with pyritic ore for manufacture of sulphur. Ore is to be delivered over a six-month period each year at a monthly rate of 4-6000 tons and will be paid for on the basis of about $13.50 per ton for 42% sulphur content, less penalties for excess aluminum, calcium, etc. The price may be changed subject to higher production costs or taxes. Their proposed contract is for ten years beginning 1953 and renewable for another ten years. Costs are estimated at about $10 per ton. The value of the copper ore which can be shipped separately at the same time should be about equal to that of the pyrite.

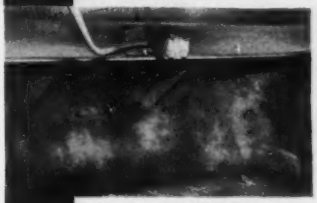
★**Gold production** in July from the nine lode gold mines had a gross value

Loosen up STUCK materials these 3 ways

1 Empty your ore cars in 10 seconds with a CLEVELAND Type LSRR Air Vibrator.



2 Vibrate the hoods over your spigot discharges with a CLEVELAND Type F Air Vibrator.



3 Use a CLEVELAND Type F Air Vibrator in your sintering operation. Easily adapted to swinging spout or other methods.

These three installations are merely representative of how CLEVELAND Air Vibration equipment can be used in mines. Types and sizes are available to fit a wide range of cars, bins, hoppers, chutes, screens, etc.

Catalog 105 will help you on your problem.

BIN STUCK LATELY?

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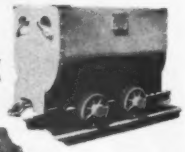
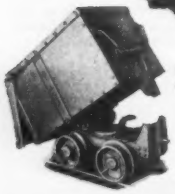
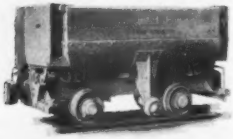
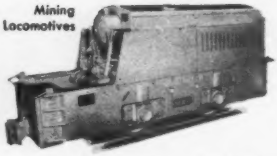

U-Body Mining Tubs


Three-Way Dump Ore Mine Cars


Granby Type Cars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Philippines *(Continued)*

of approximately $1,480,000 at the statutory price, from milling 163,000 tons. This works out to average $9.10 per ton. Value of by-product gold from Lepanto's copper ore is not included. Total value of iron ore and chromite shipped in July, $724,500 and $773,700, respectively, exceeded value of gold output by a small margin.

IN EUROPE

TURKEY

★In the wake of **intensified chrome prospecting**, the ministry of foreign trade said Turkey will export 1-million tons of chrome ore this year, compared to 600,000 tons exported in the year previous.

The ministry reported the number of mining applications nearly quadrupled in two years, 4280 in 1950, 6790 in 1951, more than 8290 in the first six months of the current year.

Magnesite exports this year will amount to 200,000 tons, the ministry predicted.

YUGOSLAVIA

★Yugoslavia today claims **first place among silver producers** in Europe, excluding the Soviet Union. Output of silver in 1951 was 94,306 kg., nearly one hundred times the 958 kg. produced in 1939.

The increase is attributed to refining from lead concentrates, started since the war at the Trepca lead-zinc mines in Serbia. This plant now contributes 95% of Yugoslav silver production.

The Harris refining system has been in use so far, but it is planned to start operating a small electrolytic plant at Trepca in 1953. About 70% of Yugoslav silver is exported.

★At the **BOR copper mine in Eastern Serbia**, an American Export and Import Bank loan is helping to finance modernization of smelting and electrolytic plants and equip a gold cyanide plant.

BOR ore averages 2.1 gr. of gold per ton. The quality of ore worked has declined, and copper content fell from 5.20% per ton in 1939 to 3.03% in 1951. A big new surface mine is being built at Maidanpek in the andesite massif north of BOR, where surveys located new reserves of low-grade ore estimated at 100-million tons. Copper content is 0.9%.

DENMARK

★It has been reported the latest testing indicated **bog iron ore deposits at Osterhoist** (northern Schleswig-Holstein) contain 20 to 25% manganese, apparently enough to insure an output of several thousand tons of the metal. The ore will be dressed by a new plant at Bollersleben.

AUSTRIA

★Mutual Security Agency has announced approval of $500,000 supplemental financing of equipment for further development of the Erzberg and Radmer deposits in Styria, southeastern Austria, operated by Austrian Alpine Montan Co.

The new dollar aid will finance the purchase in the United States of dump trucks, mechanical loaders, a mobile drill, double-deck screens, a concentrator plant, thickener and filter equipment and equipment for a washing plant, all for the main Erzberg mine installation, and a separation plant and shuttle car for the Radmer mine.

A total of **$3,111,000 has been provided** by MSA and its predecessor, the Economic Cooperation Administration, for American equipment to rehabilitate iron production in the Erzberg area. This is about 34% of the overall estimated cost.

IN THE WEST INDIES

★Recent exploration here has uncovered significant reserves of bauxite and dolomite.

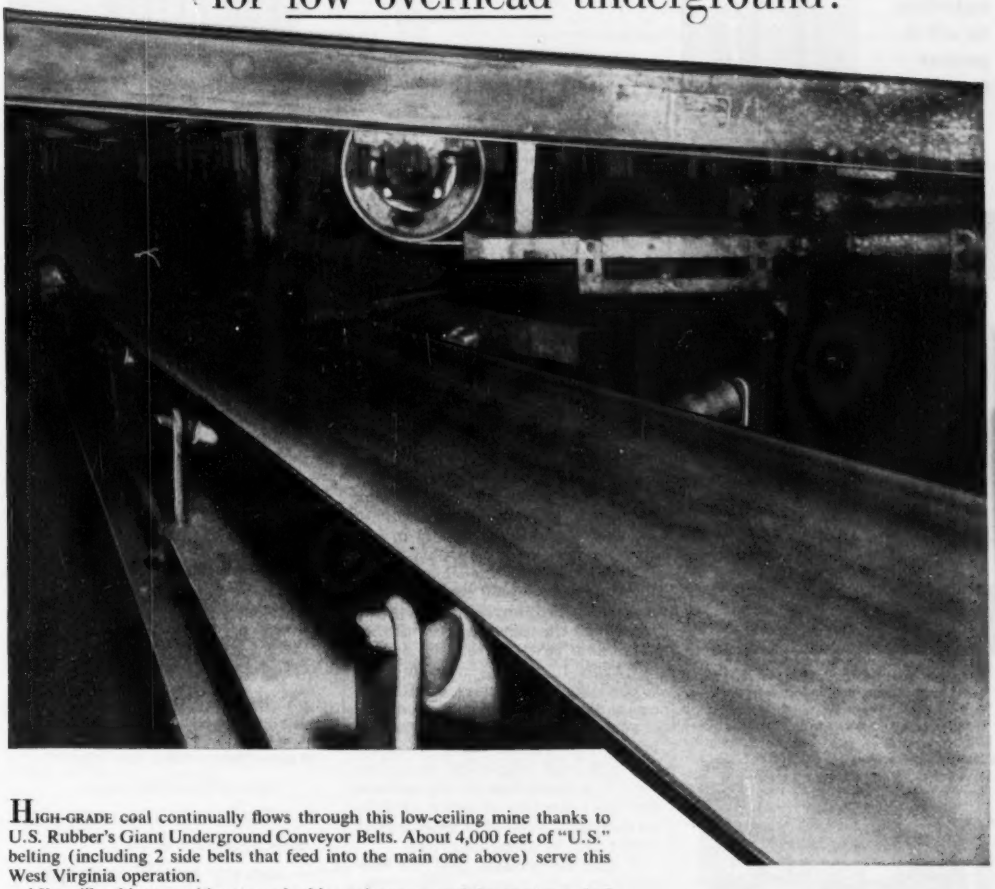
Kaiser, in a statement announcing successful completion of major explorations for bauxite, predicted mining of a 45-year reserve would be underway soon enough to schedule shipments before the end of the year. The low-cost ore will supply the company's forthcoming 130% increased capacity of primary aluminum production. Open-pit operations will extend over a 19,000-acre tract optioned by the company and equipped with a dock, living quarters, administrative offices and a research laboratory. A railroad is also being built at the site.

"Shipping of bauxite . . . directly from Jamaica to our plant at Baton Rouge," reads Kaiser's annual report, "will reduce by 60% the distance required to transport bauxite from South American sources. The haul will be 1,800 mi. shorter. An added advantage over most South American shipments is that 10,000-ton bulk cargo ore ships can load and unload bauxite directly at our docks, thus avoiding expensive rehandling.

"The Jamaican development, an important step in the complete integration of our operations from mine to metal, will result in substantial savings and strengthen our resources of raw materials."

British Aluminium reportedly is exploring an area 20 mi. from Kingston

What's U. S. Rubber doing for low overhead underground?



HIGH-GRADE coal continually flows through this low-ceiling mine thanks to U.S. Rubber's Giant Underground Conveyor Belts. About 4,000 feet of "U.S." belting (including 2 side belts that feed into the main one above) serve this West Virginia operation.

Mines like this one, with extremely thin coal seams, need the most practical conveyance system possible to make them worth working. Conveyor belts keep overhead at a minimum because they require much less operating space than other conveyor systems. Smaller tunnels, simplified timbering, more mobility, healthier, safer operation—these are other advantages made possible by U.S. Giant Conveyor Belts.

For over two years now, this "U.S." belt has weathered the terrific beating of low-mine service, maintained alignment and has not required costly repairs. You can expect the same high standard of service provided by "U.S." technicians, no matter how complex your conveyor problem may be.

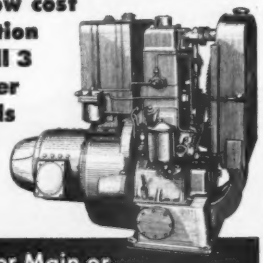
PRODUCT OF U.S. RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

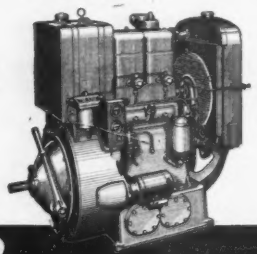
NORDBERG Diesel Units

...low cost solution to all 3 power needs



1 For Main or Standby Electric Service

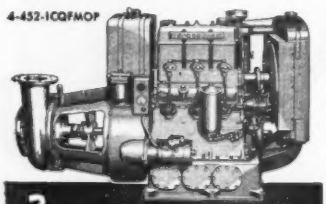
• Nordberg 1, 2 and 3-cylinder Diesel Generator Sets produce from 6 to 30 kilowatts. These sturdy, reliable units are ideal for providing main or standby electric power for almost every need.



2 For Direct Power Drive

• Nordberg Diesel Power Units offer from 10 to 45 hp for a wide range of straight power requirements, in direct drive with clutch or stub shaft power take-off.

4-452-ICQFMOP



3 For Pumping

• Nordberg Diesel Pumping Units combine low cost, reliable power with efficient centrifugal pumps for practically all pumping jobs up to 3000 gpm.

Write for literature.

NORDBERG MFG. CO., Milwaukee, Wis.

NORDBERG

BUILDERS OF AMERICA'S LARGEST LINE OF HEAVY-DUTY DIESELS

West Indies *(Continued)*

to determine whether bauxite reserves there are sufficient to justify commercial exploitation. If the company should receive a favorable report, it would seek rights similar to those the government has given American and Canadian companies.

The Geological Survey Department announced discovery of widely scattered dolomite deposits expected to yield millions of tons.

Gold Today

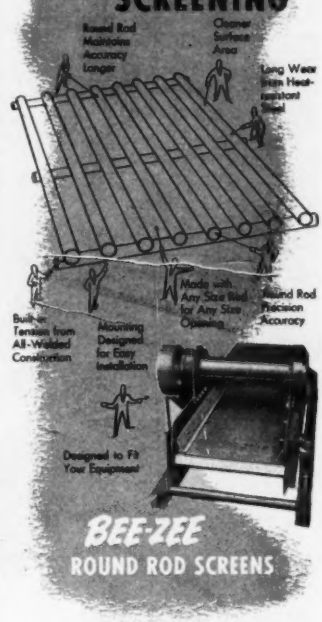
(Continued from page 104)

viewed did not regard Canada as offering at the moment any real competition to London for the custody of hoarded gold. Until Canada amends its laws authorizing the government to take over gold, there is no guaranty that the gold which a foreigner sends to Canada for storage can be re-exported again. Machinery for amending the Canadian law in this respect has been set in motion. Latin America is deemed by London gold specialists as unsuitable for the storage of gold because of political instability and the risk of revolutions.

For foreigners desiring to buy gold for storage in London, the chief bullion firms stand ready to assist in obtaining the metal in any form of bars or coins desired. The London bullion firms charge only for their safekeeping services. They may not collect any commission for acting in the purchase or sale of gold. This British prohibition does not apply to foreign companies or to foreign subsidiaries of British companies, such as the offices which one of the London firms maintains in South Africa and Canada. Through such offices and otherwise the city's know-how of the world's free gold markets is being used in marketing of semi-fabricated newly mined gold at premium prices.

It may be assumed that the city plays no inconsiderable role in the flow of non-monetary gold through such important trading and transshipment centers as Amsterdam, Zurich, Paris, Milan, Cairo, and Beirut. Nowadays industry and hoarders absorb more than twice as much gold as goes into monetary use. Last year, the Union Corp. estimates out of mine production totaling 25,700,000 oz. the industrial arts took 13,300,000 oz. and Middle Eastern and Far Eastern hoarders, 5 million oz. Of the 13,300,000 oz., the Union Corp. estimates that 5 million was hoarded in the western world.

BEE-ZEE Exclusives FOR BETTER SCREENING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Long Wear from Heat-resistant Steel
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If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field ... WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

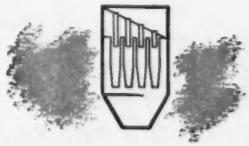
Result:

Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields ... knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* ... can give you a direct and unbiased recommendation on the matter ... and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include ...

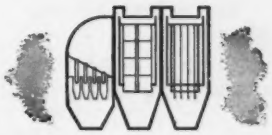
COTTRELL
Electrical Precipitators

... the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation* COTTRELLS *give highest recovery at lowest cost per-year-of-service!*



MULTICLONE
Mechanical Collectors

... the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.

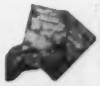


CMP UNITS
(Combination Multiclone-Precipitator)

... combine, in *one* compact installation, *both* mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) ... and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!



Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

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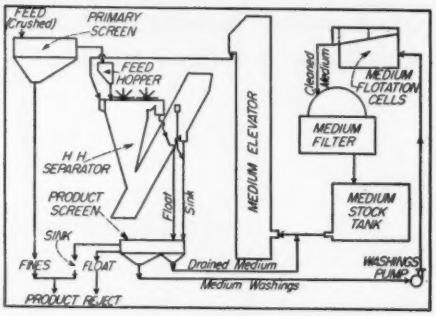
by rejecting coarse waste BEFORE final grinding

The Sink Float Process rejects coarse waste, too lean to warrant grinding and usually the hardest part of the ore. This is done before grinding, often the most expensive single step in milling. Ball or rod mill feed is, therefore, less in tonnage and softer to grind. Result—lower capital cost, lower operating cost, less over-grinding, better recovery.



H. H. SINK FLOAT PROCESS

PRE-ENGINEERED • PRE-FABRICATED

Recent developments in this widely-used ore separation process, have resulted in increases in metal recoveries, reduced concentration costs, savings in man-hours and increase in metal reserves.

Other advantages realized through the H. H. Sink Float Process include:

- . . . ability to make closer separation on difficult feeds
- . . . positive control of separation density
- . . . positive removal of float product
- . . . positive removal of sink product
- . . . less power required for operation
- . . . ability to treat coarser sizes
- . . . easier to start after shut-down
- . . . easy to run . . . any mill operator can run it
- . . . low first cost per ton treated

Additional features of this process are:

- . . . rejects coarse waste without grinding it
- . . . produces coarse market concentrate
- . . . permits non-selective mining
- . . . treats metallics as well as non-metallics
- . . . treats mine ores, dumps, fill, development ore
- . . . serves existing and new installations

The H. H. Sink Float Plants are pre-engineered and pre-fabricated with economy in time and construction costs.

It will be to your advantage to explore the possibility of the H. H. Sink Float Process. Let us give you the names of plants now operating this process. Write for further information today.

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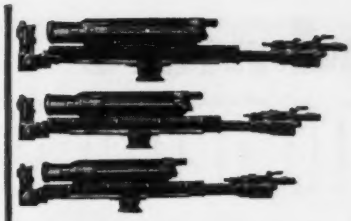
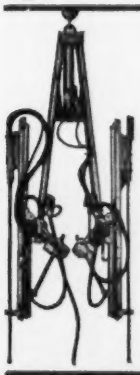
100 PARK AVENUE NEW YORK 17, N. Y.

★ Air-feed sinkers — 2-way feed, 2 sizes. They take the back-breaking work out of drilling horizontal holes, lighten the load on your miners, and increase tonnages.



★ Power-feed and hand-cranked drifters. Dependable, powerful, and fast. Ideal for columns and jumbos alike.

★ A complete line of sinkers from 18 to 80 lbs. including the popular 45-lb. H10, and 55-lb. H111.



★ The SDR 34 shaft sinker for faster sinking. Easily closed it's 5'6" between drill centers; open 19'3". All adjustments quickly made with air motor.

It's Le Roi-CLEVELAND

for

Rock Drills You Can Count On

. . . . . fast-drilling, dependable favorites of mining men since 1906

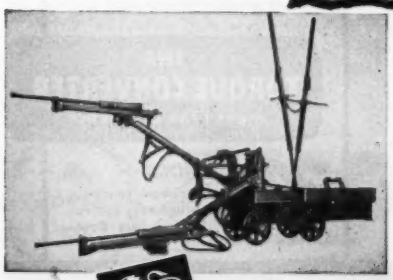
Of course, you know that Le Roi-CLEVELAND builds the popular, easy-holding H10 and H111 sinkers... the fast-drilling PD24, 25, and 14 power feed drifters . . . the S11 and SS22 stopers with trip rotation for easier handling . . . and a mine jumbo that lets you drill out your rounds faster, with greater safety.

But did you know that Le Roi-CLEVELAND was responsible for some famous "firsts"? Here are a few of them—work-savers that help your miners increase their man-shift production: the air-feed sinker, the offset stoper, the shaft sinker, the stoper jumbo.

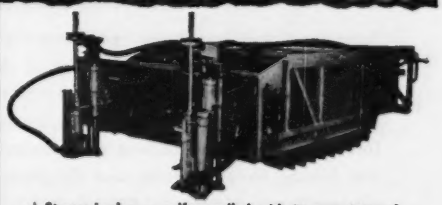
So if you have a job of drilling to do—do it with Le Roi-CLEVELAND machines. You can count on them. They're built for speed. And they're built to stay underground, too — where you can use this speed to do more work and cut your costs.

Detailed information about the complete Le Roi-CLEVELAND rock drill line is yours for the asking. Just write us.

★ Stopers for every need — the 90-lb. S11, the 120-lb. SS-22, and a complete line of offset stopers with 36-inch steel changes for deep holes, or with short feeds for confined spaces.



★ The famous MDR Jumbo with air-motor poweredbooms for quicker set-ups, greater safety, faster rounds.



★ Stoper jumbo — self-propelled with its own integral dust-collection system for positive dust control, the latest thing for roof bolting.

LE ROI

LE ROI COMPANY

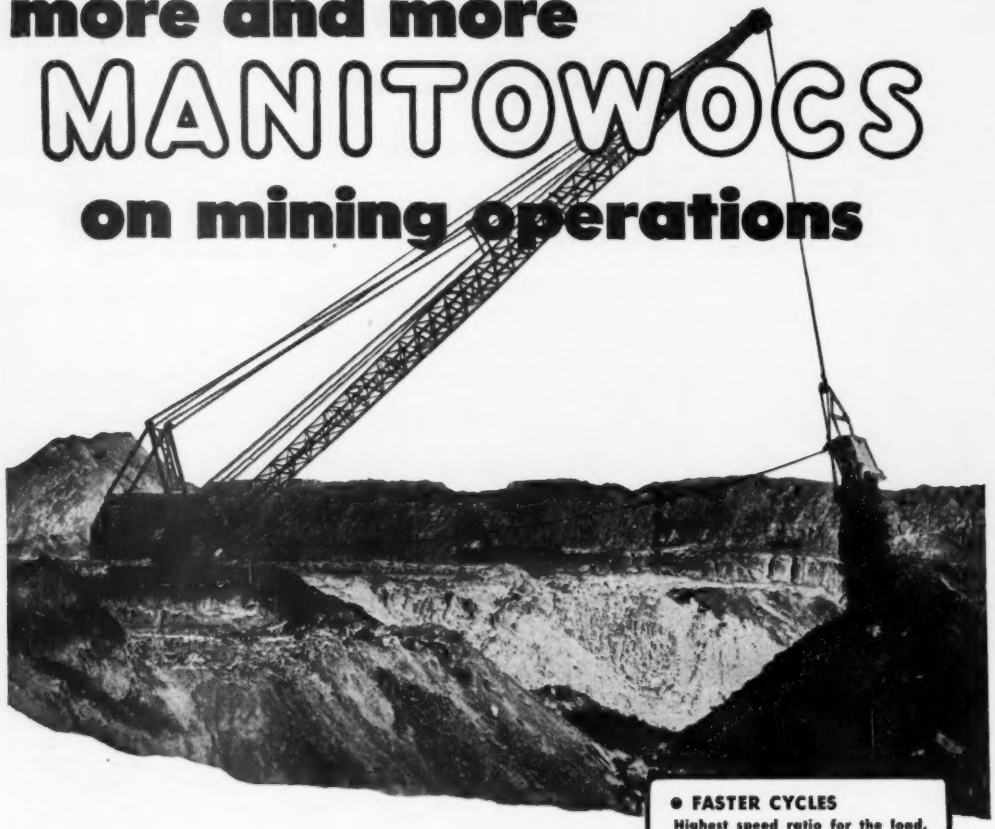
RD-39

CLEVELAND ROCK DRILL DIVISION

12500 Berea Road, Cleveland 11, Ohio

Plants: Milwaukee, Cleveland and Greenwich, Ohio

more and more MANITOWOCS on mining operations



There's a big swing to Manitowoc excavators on every phase of mining — from stripping to loading — because Manitowocs are built for these jobs — with special long-reach dragline booms; long "hi-lift" shovels; large, wide crawlers; built-in stability — all the factors that contribute to big, steady output.

From the Mesabi Iron Range, to the coal fields of Pennsylvania, Manitowocs are becoming first choice of the experienced operators—those who've tried them all are switching to Manitowocs, and the repeat orders reveal their satisfactory performance. Before you buy your next machine, get complete details on Manitowoc Mining Shovels, Cranes, and Draglines. Manitowoc Engineering Works, Manitowoc, Wisconsin.

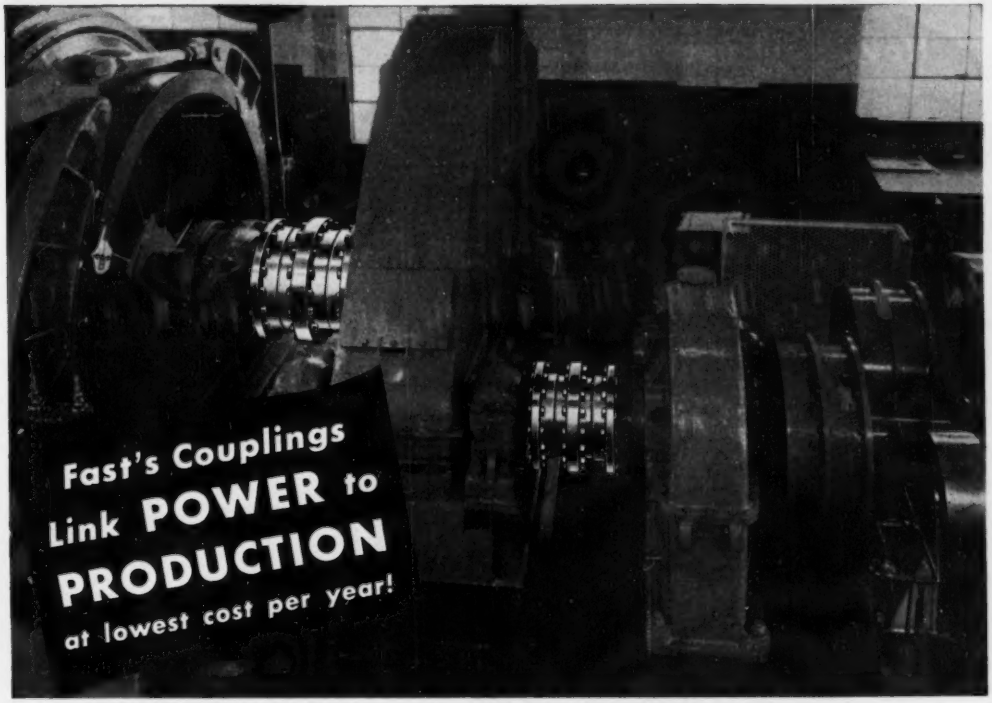
- **FASTER CYCLES**
  Highest speed ratio for the load, automatically selected. Speeds increased as much as 25% with complete safety for machine and operator.
- **FULL ENGINE POWER**
  Engine never lugged down below full speed load — Converter boosts torque, increases bail pull, without pulling down engine speed.

THE TORQUE CONVERTER makes the difference

- **ABSORBS SHOCK**
  Oil cushion absorbs shock loads . . . reduces machine breakage, assures longer parts life and less down time for maintenance.

MANITOWOC Speedcrane

SHOVELS ½-5 YD. CRANES 18-100 TON



FAST'S Couplings usually outlast the equipment they connect!

ACTUAL cases on record show many Fast's Couplings are still in service after as much as 30 years of continuous operation! Time and time again, equipment has been replaced while the original Fast's Coupling remained on the job.

To you, these records of dependable, trouble-free service mean freedom from costly coupling failures when you specify Fast's. And they mean Fast's cost you far less to own and operate . . . because their cost can be amortized over long years of dependable performance.

For full details on how Fast's Couplings and Koppers Engineering Service can help you, write today for a free copy of our catalog to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 390 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS

FAST'S®
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.,*
390 Scott St., Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

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Company _____

Address _____

City _____ *Zone* _____ *State* _____

Have you discovered these Hidden Values in Red-Strand wire rope?

You get 3 important, unseen values in Hercules *Red-Strand*.

The first is *extra endurance*.

The second is *consistently high performance*.

The third is complete *dependability*.

These values are made possible by Leschen's exacting insistence upon *higher-than-rated* quality . . . by precise, specialized manufacturing craftsmanship . . . and by the constant use of only the finest known grade of steel for long-lasting Hercules *Red-Strand* wire rope.

Service records prove these hidden values. Your records will too.

Higher operating profits may be yours with Hercules *Red-Strand* wire rope. Talk it over with your Leschen wire rope specialist . . . before you place your next rope order. Or, write for bulletin.

A. Leschen & Sons Rope Co., St. Louis 12, Missouri
In business *only* to make wire rope — *better* wire rope — *since* 1857.
DISTRIBUTORS IN ALL PRINCIPAL CITIES

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comfortable eye protection

keep on the safe side

wear WILLSON GOGGLES

Willson goggles offer you greatest value because they are carefully designed for comfort and appearance as well as for the eye protection you need. Choose from a wide range of Cup and Cover-All* types like those illustrated. All are fitted with Super-Tough* heat-treated glass lenses—all fully pre-tested. You're sure when you ask for Willson goggles—safer when you wear them.

COVER-ALL® CUP GOGGLE No. CC60

Heavy duty goggles allowing plenty of room for prescription glasses to be worn safely and comfortably.

RUBBER MASK GOGGLE No. X41

Ideal for chemical workers. Rolled inner edge makes them fit snugly with utmost ease.

STYLE DL31

Deep perforated metal cups provide direct ventilation yet exclude dust. Ideal for use in hot, dusty atmospheres.

See your Willson distributor or write for bulletin
WILLSON PRODUCTS, INC.
225 Washington St., Reading, Pennsylvania

Kick the tires and hope for the best

The first car you bought. The world may have been yours as you rolled triumphantly on your way. Or perhaps your face was beet red as your best girl helped you push your investment the last part of the way home.

At your desk today, you place most orders by specification. You find quality control and performance tests useful safeguards. Still, conditions being what they are, too frequently you have to hope for the best.

What is your best protection? Probably you agree with other business men who were asked recently. These executives, who account for more than 85 per cent of all Multiwall bag purchases, spelled it out*: The reputation of the seller.

Union has been the acknowledged leader in paper packaging for 76 years. Multiwall buyers who specify Union know their bags are being supplied by the company best qualified to help them develop a better package.

They have a further reason for confidence. Union's record of fair play.

Fair play in pricing. Fair play in allocating bags. Fair play in regarding delivery dates as pledges to be met.

This is the kind of treatment that has influenced knowing Multiwall users to place a greater share of their orders with Union.

It is the kind of treatment you can depend upon.

More so every day . . .

IT'S UNION FOR MULTIWALLS

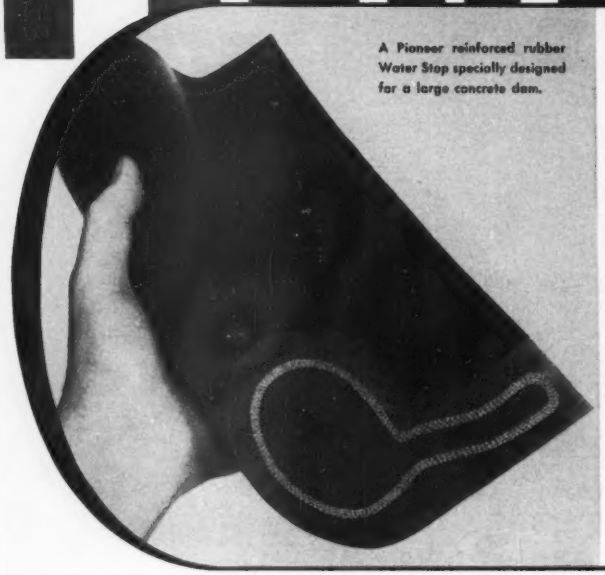
TRADE MARK UNION

*August, 1951 research study.

UNION BAG & PAPER CORPORATION • WOOLWORTH BUILDING, NEW YORK 7

Industrial rubber products especially built for LONG SERVICE

PIONEER



A Pioneer reinforced rubber Water Stop specially designed for a large concrete dam.

These Water Stops let dams move without leaking

Here is one of the most versatile of Pioneer's big family of industrial rubber products. It is called a Water Stop, but also serves as an expansion joint between sections of concrete structures. It allows concrete to settle, expand, contract, or shift under loads without cracking and without leaking.

Not only dams, but highways, bridges, locks, irrigation canals, caissons, water gates, and similar structures are best protected and kept watertight with Pioneer Water Stops, "J" Seals, or other molded rubber shapes. You can depend on Pioneer's experience to provide the *correct* answer in shape, type of rubber, resilience, reinforcement, and other factors.

The great number of these molded products developed by Pioneer illustrates again an uncommon ability and *willingness* to work with you, as a customer, in solving your specific requirements. It will pay you to contact your nearest Pioneer Rubber Mills representative.

PIONEER RUBBER MILLS

Pioneering in rubber since 1888

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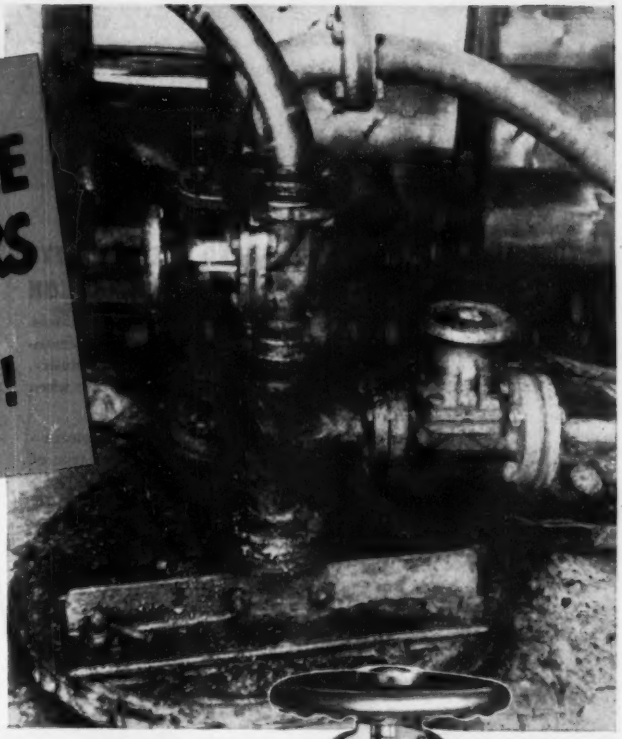
TROUBLE FREE FOR 15 YEARS handling muriatic acid!



Another 'open and closed' case for

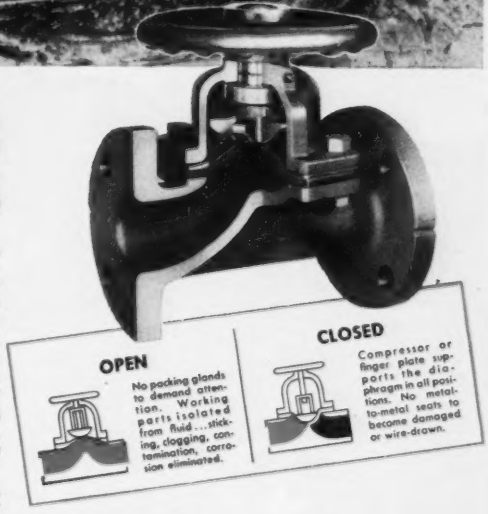
GRINNELL-SAUNDERS DIAPHRAGM VALVES

In 1936, a Canadian mine installed Saunders Diaphragm Valves with rubber linings on the feed and drain piping of an underground tank used for the storage of muriatic acid. Today, after 15 years, those *same* valves are in use—having required no maintenance except for periodic replacement of diaphragms, a simple operation done without removing the valve from the line.

Grinnell-Saunders Diaphragm Valves are available in many different combinations. Bodies are made in a variety of metals —iron, stainless steel, bronze, aluminum and others. ***But of more importance*** is the fact that a body of cast iron (a metal not in short supply) can be lined with glass, lead, natural rubber, neoprene and other materials which, in many instances, handle corrosive fluids *better* than metals.

Diaphragms come in natural rubber, neoprene, butyl, hycar, a special synthetic for foods and KEL-F. This last is chemically inert to all acids and alkalies in all concentrations with the exception of molten alkali metals.

From this broad selection of materials, the problems which the Grinnell-Saunders valve can solve are extremely varied. No wonder industry after industry is putting it on the line.


OPEN
No packing glands to demand attention. Working parts isolated from fluid... sticking, clogging, contamination, corrosion eliminated.
CLOSED
Compressor or finger plate supports the diaphragm in all positions. No metal-to-metal seats to become damaged or wire-drawn.

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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PRECISION-MADE...PERFORMANCE-ENGINEERED ...SERVICE-PROVED

MIDVALE FORGED STEEL SHAFTS SERVE INDUSTRY ACROSS THE NATION

Whether it is mammoth shafts for turbines or generators, or extra heavy shafts of any description, Midvale craftsmanship means top performance. Industry after industry, from coast to coast, has learned to rely on Midvale when specifications are exacting and the job is big.

Whatever your needs for heavy custom-built equipment—whether shafts, rolls, pressure vessels, or any other type of forging—Midvale is your guarantee of precision and performance. For at Midvale, modern equipment and quality control are combined with years of skill and experience to produce the finest, most dependable heavy steel forgings industry can produce.

When heavy forgings must meet rigid specification, rely on Midvale precision craftsmanship.

THE MIDVALE COMPANY
NICETOWN • PHILADELPHIA 40, PENNA.
Offices: New York, Chicago, Pittsburgh, Washington
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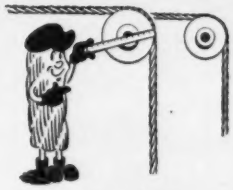
MIDVALE
Custom Steel Makers to Industry
PRODUCERS OF FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

Shovel and Dragline Operators

do you want to cut operating costs?

J&L STEEL

Here are a few tips on longer Wire Rope Service Life!

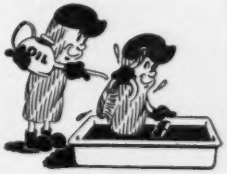


Avoid Small Drums and Sheaves

Keep Lines from Rubbing

Keep Drums and Sheaves Aligned

Check Your Sheave and Drum Grooves



Lubricate Your Lines Regularly

Use Jacks When Transferring Lines from Reel to Drum

SPECIFY J&L WIRE ROPES FOR YOUR EQUIPMENT

Proof of the value of any wire rope lies in its performance on the job. The unexcelled performance record of J&L Wire Ropes can be traced to J&L's *quality control* method of manufacture. *Quality control* that ensures the finest finished product by regulating every step in the manufacture of wire rope from the mining of iron ore to final stranding and closing operations. The result is wire rope that provides maximum service life—helps keep your operating costs to a minimum by cutting down time for re-rigging and making possible maximum production per wire rope dollar.

If you're not already using J&L wire rope, why not contact your nearest J&L representative *today*.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PA.

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First choice where the going's toughest

From the frozen Arctic to sweltering Africa, Longyear Diamond Core Drills have proved they are fast, rugged, dependable. Their smooth "straitline" power delivery to the drilling head increases bit life and speeds drilling progress—compact design makes operation easier—rugged construction cuts maintenance to the bone.

Select the Longyear drill that will give you maximum drilling progress under the toughest conditions. Write today for Bulletins describing the wide choice of models, capacities and power units in the complete line of Longyear Diamond Core Drills.

E. J. LONGYEAR COMPANY

1700 FOSHAY TOWER MINNEAPOLIS, MINNESOTA, U. S. A.

DIAMOND CORE DRILLS • CONTRACT CORE DRILLING
SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

Coppus VENTAIR (centrifugal type)

Coppus VANO (propeller type)

Choose between them and get 30% to 100% more air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ⅔ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
290 Park Avenue, Worcester 2, Mass.

Please send..... Bulletin 130

Name.....

Company.....

Address.....

The Tonnage of the WORLD'S Metal Mining Industry *is filtered on*

VISIT the large mills not only in the United States but in Canada, Mexico, South America, South Africa and Australia and what do you generally find washing cyanide residues or dewatering flotation concentrates? Batteries of Olivers, Americans or Dorrcos . . . sometimes all three types!

Drop in on the small, 50 ton mills and you will find the same "name" filters . . . single units in most cases and perhaps smaller but the same efficient, dependable units you saw in the large mills.

Since this parade of Oliver United Filters began back in 1907 —more than 40 years ago—it implies an exceptional amount of experience in the broad field of ore filtration . . . an experience we doubt can be duplicated anywhere else. Such experience means that the Oliver, American or Dorrco filter you buy today is the most modern, most efficient, most suitable unit you can obtain.

Isn't this what you want in that new filter you need?

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Steel

BULWARK OF FREEDOM BUT . . .

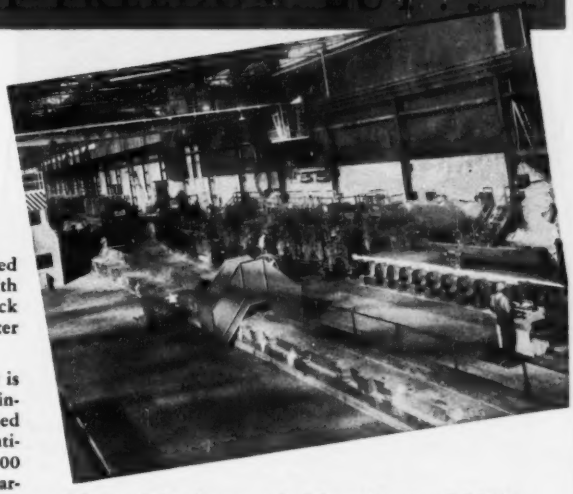
Vulnerable to Socialistic Rust!

Urged on and on by the incentives afforded by our free enterprise system—Americans, with the private money of thousands of stock holders, have built a Bulwark of Steel greater than all the rest of the world.

The capacity of America's steel industry is so great that in 24 hours, it can turn out ingots and castings sufficient to provide finished steel for—500 airplanes, 500 tanks, 1,000 anti-aircraft guns, a half million 3-inch shells, 1,000 howitzers, 2,000 aerial bombs, 1 aircraft carrier, 2 heavy cruisers, two cargo ships, two tankers, 1,000 freight cars, 2,000 trucks, 12,000 automobiles, 20,000 refrigerators, 20,000 stoves, 2,000 homes, and still have 23,000 tons of steel for other purposes.

Remove the incentives of free enterprise or burden it with excessive restrictions and our magnificent steel industry will be vulnerable to the wasting erosion of socialistic rust.

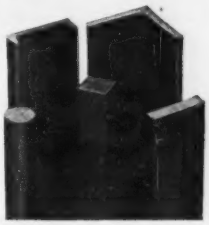
SHEFFIELD STEEL CORPORATION
HOUSTON KANSAS CITY TULSA
SUBSIDIARY OF ARMCO STEEL CORPORATION



Most Modern of Merchant Mills

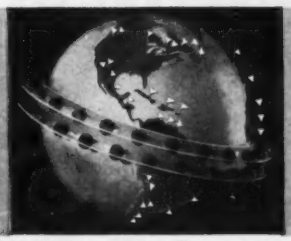
On this highly mechanized 12-inch merchant mill, steel billets are more efficiently rolled into a wide variety of merchant shapes and sizes vital to manufacturing.

It is a typical example of the continuing modernization and expansion program of Sheffield Steel which, in the last ten years alone, has more than tripled the at-home steel making capacity of Sheffield Steel mills. New furnace and blooming mill capacity now under construction will enable Sheffield Steel to continue to pace industrial progress with an ever increasing supply of steel—the vitamin A of industrial growth.



SHEFFIELD
MERCHANT STEEL
There are few industries that do not use merchant steel. Sheffield Steel mills roll a wide variety of bars and shapes.

SHEFFIELD
MOLY-COP
TRADEMARK REG.
COPPER-MOLYBDENUM-ALLOY
Grinding Balls



USED AND PROVED ALL AROUND THE WORLD

Sheffield Products: Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Hot Rolled Bars, Steel Joists, Structural Shapes, Reinforcing Bars, Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

Export Representative: ARMCO INTERNATIONAL CORPORATION • Middletown, Ohio

NOTES FROM THE PUMP ENGINEER'S HANDBOOK

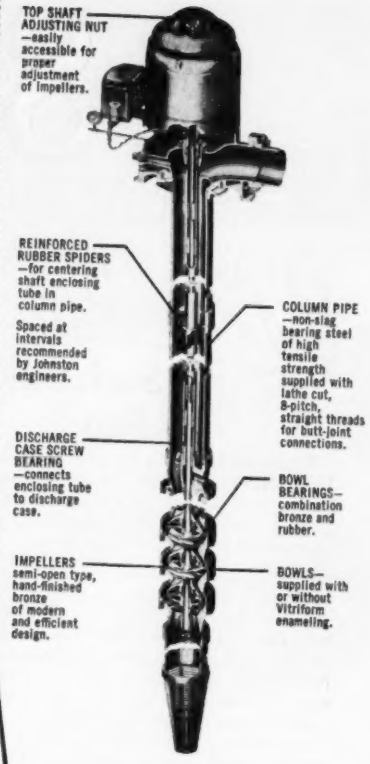
Little Details Like the XXX Seal Make Johnston Pumps Better!

Johnston pump bowl assemblies fitted with enclosed impellers have the Johnston XXX Seal—just another small detail that makes each Johnston the pump with real inside qualities. The design of the Johnston Seal, formed by the impeller shroud and the wear ring, provides sealing surfaces which prevent *any loss of efficiency* caused by liquid by-passing.

The extra hardness of the renewable aluminum bronze wear ring over standard bronze construction gives added protection, longer life and higher *sustained* pump efficiency. This is just one of the many little inside quality features that make each Johnston Pump better.

Every Johnston Pump is engineered for the specific duty for which it is intended. Trained hydraulic engineers are available at your nearest Johnston Dealer or at the Johnston factory to furnish detailed information, proposals and anything else necessary to meet your particular pumping equipment needs. Compare the inside qualities of Johnston Pumps and you'll never buy any other!!!

Sizes from 4 to 32 inches; single- or multi-stage; 2 to 1000 H.P.; capacities to 10,000 G.P.M.; lifts to 1000 feet; for liquid temperatures to 400° F.


TOP SHAFT ADJUSTING NUT —easily accessible for proper adjustment of impellers.
REINFORCED RUBBER SPIDERS —for centering shaft enclosing tube in column pipe.
Spaced at intervals recommended by Johnston engineers.
COLUMN PIPE —non-slag bearing steel of high tensile strength supplied with lathe cut, 8-pitch, straight threads for butt-joint connections.
DISCHARGE CASE SCREW BEARING —connects enclosing tube to discharge case.
BOWL BEARINGS— combination bronze and rubber.
IMPELLERS semi-open type, hand-finished bronze of modern and efficient design.
BOWLS— supplied with or without Vitriform enameling.

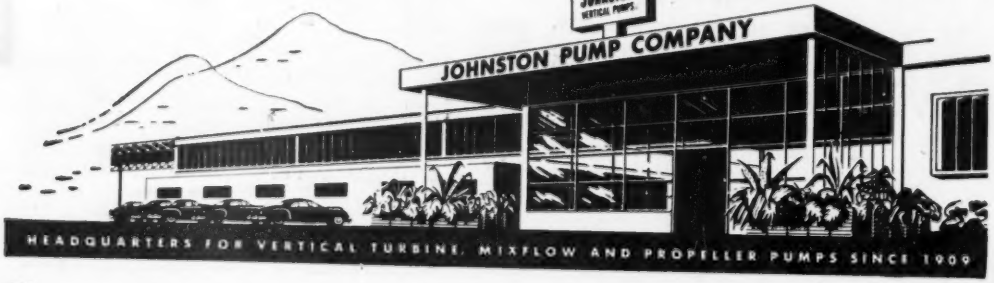
Johnston Turbine Pumps are made for a wide variety of uses in the mining industry. They are designed for primary water supply; for sump and booster pumping; for dewatering. They have literally hundreds of applications.

Due to the interchangeability of component parts, a Johnston is so flexible that the same unit may be adapted to many types of pumping operations. The selection of the correct pump for the job is dependent upon field conditions and the results required.

After a survey of your requirements, Johnston engineers recommend the type and size of turbine pump that's most economical and satisfactory for the job. It may be oil lubricated or water lubricated, with semi-open or closed type impellers. For corrosive liquids special materials are available . . . no matter what the conditions, the Johnston Turbine pump you buy is engineered to meet your needs.

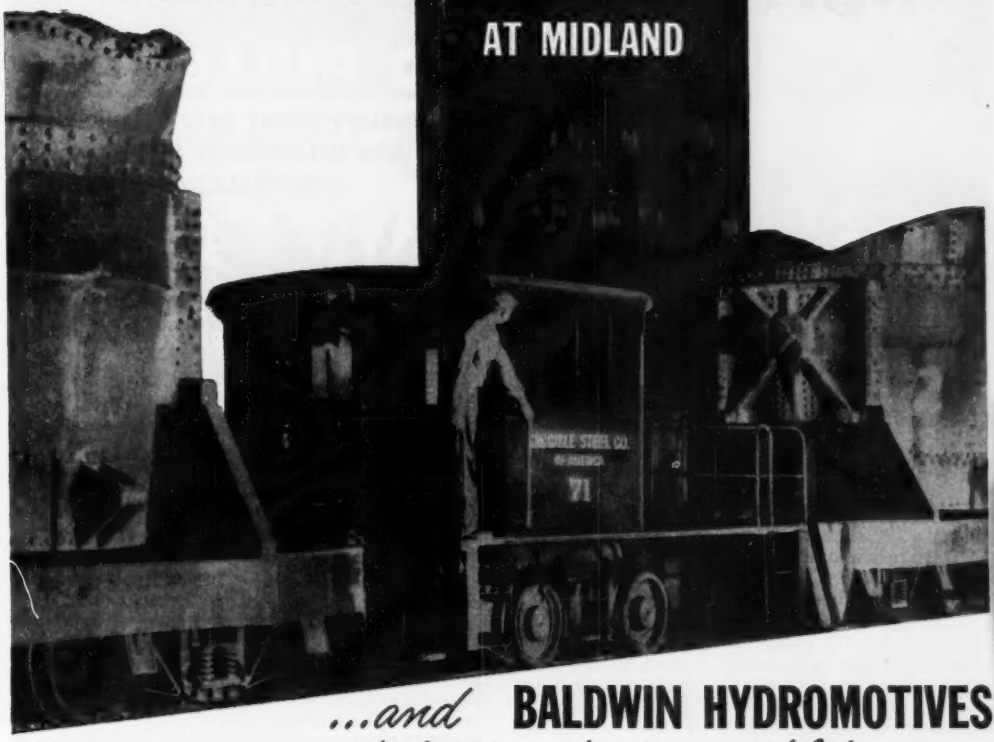
JOHNSTON PUMP COMPANY
3272 EAST FOOTHILL BLVD., PASADENA 8, CALIFORNIA

JOHNSTON VERTICAL PUMPS



HEADQUARTERS FOR VERTICAL TURBINE, MIXFLOW AND PROPELLER PUMPS SINCE 1909

SMASHES ALL CRUCIBLE RECORDS AT MIDLAND



...and BALDWIN HYDROMOTIVES *helped make it possible!*

Crucible had a tough materials-handling problem in its open hearth and conditioning departments at Midland. When a crane ran a load the length of the building, other cranes were stacked up against the ends. Vital time was lost . . . tempers were frayed.

Then two Baldwins were purchased to handle these hauls . . . to feed the cranes stationed along the floor. Stoppages were cut to a minimum, handling time reduced . . . an all-time production record set.

Because Baldwin Locomotives operate so easily, control so easily, give the operators extra visibility in every direction, they are a favorite choice of astute managers interested in solving materials-handling problems. A favorite too, because of the surprisingly low maintenance and fuel costs . . . as proved at Midland and many other plants.

Interested in speeding up your haulage operations in switchyards or in the plant? If you are, we'd like an opportunity to show you what Baldwin Locomotives have done for others . . . what they can do for you. Call or write your nearest Baldwin representative.

BALDWIN-LIMA-HAMILTON CORP.
Philadelphia 42, Pa.
Offices in Principal Cities

- Diesel-hydraulic Locomotives from 12 to 35 tons
- Diesel-electric Locomotives from 25 to 95 tons
- Diesel-mechanical Locomotives in 5 and 8 tons

BALDWIN - LIMA - HAMILTON

NEW Cedarapids Built by IOWA Schrock Motorized HEAD PULLEYS

SIMPLIFY EVERY BELT CONVEYOR AND BELT-BUCKET ELEVATOR INSTALLATION

IT'S COMPLETELY DIFFERENT FROM CONVENTIONAL CONVEYOR DRIVES

Everything is contained **INSIDE** the pulley!

ELIMINATES ALL MAINTENANCE ON SPROCKETS, CHAINS, JACK-SHAFTS, V-BELTS, ETC.

U.S. Pat. No. 3548399 Others Pending

WHAT A *Motorized* HEAD PULLEY IS

THIS is a revolutionary departure from the conventional types of conveyor drives. A *motorized* head pulley is a fabricated steel pulley with *everything*... electric motor, reduction gears and all moving parts . . . contained inside the drum! It's simply a new application of the long-proven gear reduction drive, and because of its simplicity, it's the answer to the maintenance man's prayer. 70% to 90% of conveyor down time is saved by eliminating all countershafts, speed reducers, sprockets, chains, Universal shaft drive and other parts necessary with conventional pulley drives. Motorized Head Pulleys are simple to install and flexible in use, completely interchangeable and adaptable to all types of belt and belt-bucket conveyor installations. By means of a simple adapter, a single pulley can be utilized in any of several belt locations, operating various widths of belt, or changing from larger or smaller horsepower. Pulley sizes range from 5 to 30 HP and are available in various widths. A Motorized Head Pulley is safe, because there are no sprockets, chains, jack-shafts, V-belts, etc. to endanger personnel. It's compact...requires no more room than a conventional pulley. Complete protection from weather, grit and dirt also reduces maintenance. Cedarapids Schrock Motorized Head Pulleys have been jobtested for many years under severest working conditions.

HOW IT WORKS

The pulley shell rotates about the electric motor, which is held stationary by means of a torque arm attached to the conveyor frame. The speed of the shell depends upon the combined reduction ratio of the various pinions and gears contained within the pulley shell. This reduction starts with a primary pinion mounted on the motor shaft and ends in the ring gear attached to the shell. The shell in turn then drives the conveyor belt. Leads to the motor enter the head pulley through a hollow conduit passing through the drum end bell and bearing. A simple oil bath gear compartment provides a lubricating bath for the reduction gears and front motor bearing. Motor and head pulley are cooled and ventilated by holes in the drum.

GET COMPLETE DETAILS TODAY

Find out all the advantages of converting your conveyor installations to motorized efficiency before you need head pulley replacements. One internationally known company has 50 Motorized Head Pulleys installed on widespread conveyor operations, and plans more for every installation that requires replacement. Get complete details about every feature. See your distributor today, or write direct to Iowa Manufacturing Company.

IOWA MANUFACTURING CO.
Cedar Rapids, Iowa, U.S.A.

Built for sale in Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah and Washington.

YUBA MANUFACTURING CO.
Pulley & Sprocket Dept., Benicia, California

Every CUMMINS DIESEL is built not once but twice

Miners have learned to count on Cummins Diesels for dependable power day in, day out.

What's behind this consistent reliability? One good reason is the fact that every Cummins Diesel is actually built *twice*. After initial assembly, and run-in testing, every engine is disassembled, inspected; then reassembled and tested again.

This extra care—together with Cummins' economy-proved fuel system and efficient parts and service organization—makes lightweight, high-speed (50-550 h.p.) Cummins Diesels a wise first choice *for men who depend on power.*

Whatever your power needs . . . whether it's for stripping or hauling, portable power units or generator sets—or any other important jobs . . . your Cummins dealer is the man to see.

CUMMINS ENGINE COMPANY, INC., Columbus, Indiana

Export: Cummins Diesel Export Corporation
Columbus, Indiana, U.S.A. • Cable: CUMDIEX

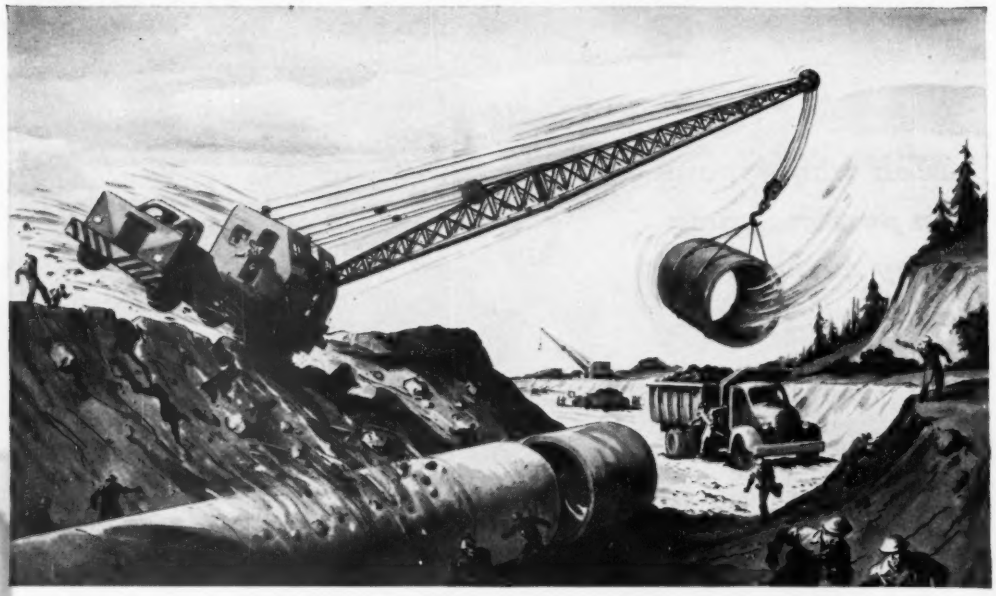
(M-60)

CUMMINS Achieved DIESEL

TRADEMARK REG. U. S. PAT. OFF.

***Leaders* in lightweight, high-speed diesel power!**

"Accidents, injuries and death are the same the world over"



...BUT NOT LIABILITY!

That is why sound insurance protection on *your* foreign interests must be written and serviced by qualified experts on the laws and insurance regulations of the countries where your operations are located.

The *American Foreign Insurance Association* has been a leader for decades in providing American business ventures overseas with just that kind of protection . . . steadfast protection founded upon professional observation of the local conditions and laws of nearly every land throughout the world.

No matter where your property and materials are located in foreign lands . . . or whether you employ foreign nationals or Americans, AFIA, thru its member companies, protects YOU with the "right" insurance for practically every phase of your business.

When trouble strikes, AFIA stands firmly behind YOU with the great financial resources of its 24 outstanding American capital stock member insurance companies . . . one of the strongest insurance groups of its kind in America.

Ask your agent or broker to get full information for you from AFIA.

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SAN FRANCISCO OFFICE: 98 POST STREET, SAN FRANCISCO 4, CALIFORNIA
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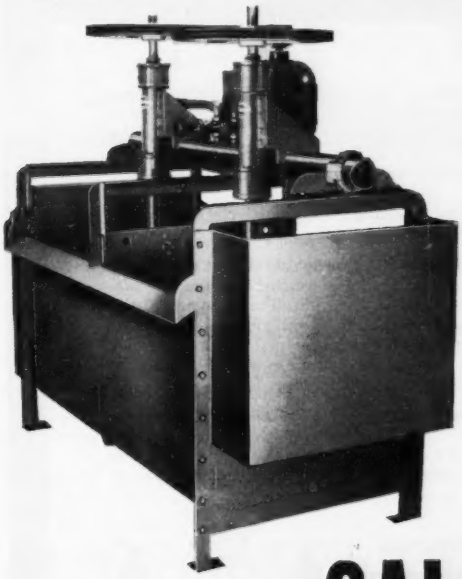
AN ASSOCIATION OF AMERICAN CAPITAL STOCK FIRE, MARINE AND CASUALTY INSURANCE COMPANIES PROVIDING INSURANCE PROTECTION IN FOREIGN LANDS

ARIZONA and AGITAIR is there!

highly efficient flotation... copper and copper-zinc.



The plant shown above—located in Arizona—is a typical concentration mill, of 1500-ton daily capacity, with separate flow sheets for copper ore and copper-zinc ore. AGITAIR is used exclusively in this modern mill and is given large credit for a profitable operation.

AGITAIR Flotation is serving in every metal state of the union and in every major metallurgical region throughout the world. The famed machine has achieved this universal acceptance for one basic reason: HIGHER RECOVERY AT LOWER COST!

Galigher engineers are at your service through correspondence or personal conference. Submit your problem to men who know!

Leaders in Experience & Service

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METALLURGICAL DIVISION · THE GALIGHER COMPANY · ENGINEERING SERVICE

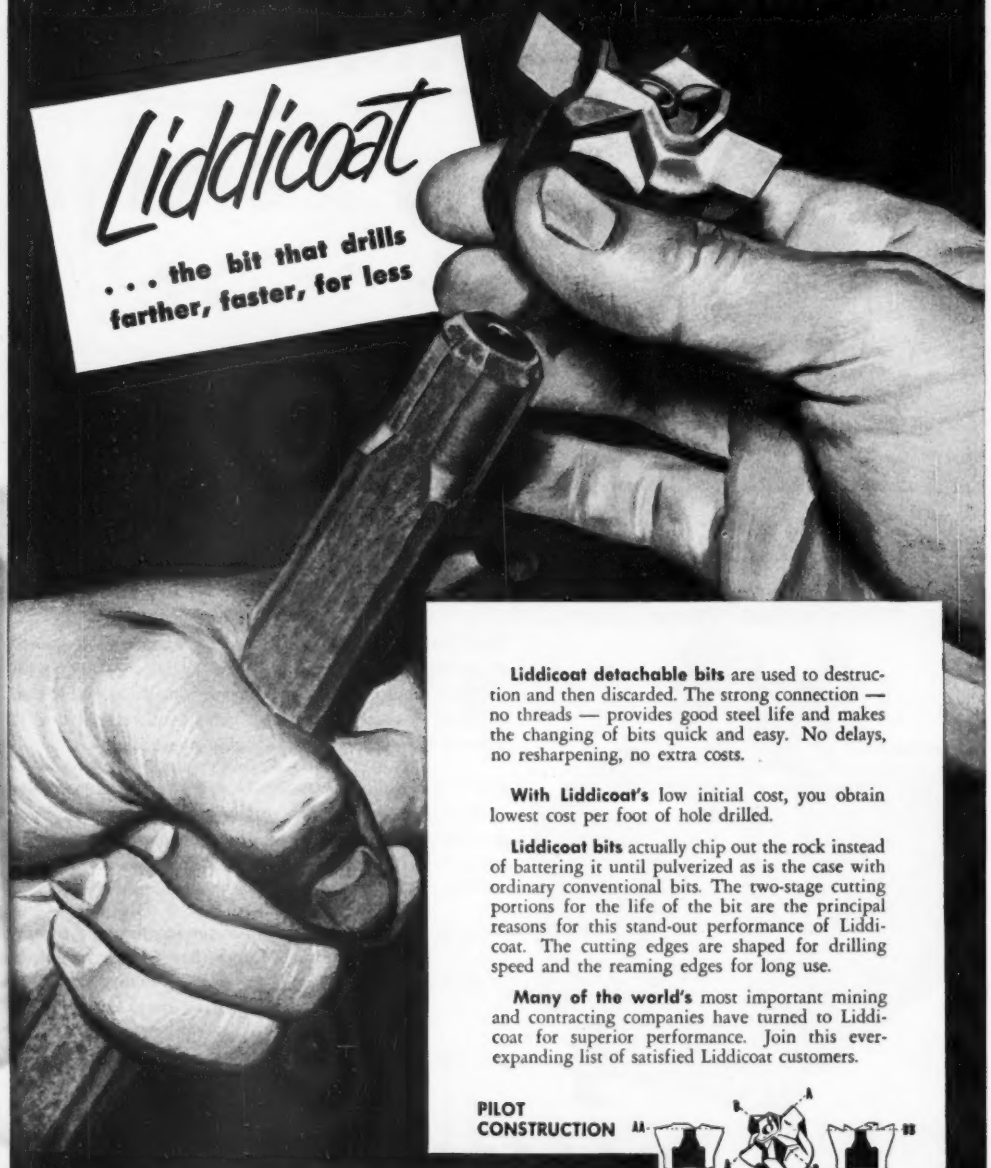
CONSULTATION • ORE TESTING
PLANT DESIGN • CONSTRUCTION

Representing: GENERAL ENGINEERING CO. of CANADA, Ltd., U. S. A., MEXICO, SOUTH AMERICA

USED TO DESTRUCTION...NO RESHARPENING

Liddicoat

. . . the bit that drills farther, faster, for less



Liddicoat detachable bits are used to destruction and then discarded. The strong connection — no threads — provides good steel life and makes the changing of bits quick and easy. No delays, no resharpening, no extra costs.

With Liddicoat's low initial cost, you obtain lowest cost per foot of hole drilled.

Liddicoat bits actually chip out the rock instead of battering it until pulverized as is the case with ordinary conventional bits. The two-stage cutting portions for the life of the bit are the principal reasons for this stand-out performance of Liddicoat. The cutting edges are shaped for drilling speed and the reaming edges for long use.

Many of the world's most important mining and contracting companies have turned to Liddicoat for superior performance. Join this ever-expanding list of satisfied Liddicoat customers.

PILOT CONSTRUCTION

Section "AA", along the high-centre wings. Section "BB", along the low-centre wings.

WESTERN
Rock Bit Manufacturing Company

552 West 7th South • Salt Lake City 4, Utah

EVERY LITTLE BIT COUNTS

9 reasons why reliable REDSHOT* is the choice of the blasting crew

Hazard Redshot is the only shot firing cord made in the easy-to-separate, round, parallel form.

Made to the specifications of the explosives engineer... that's Hazard Redshot. Precision manufactured for mining operations, only Redshot can offer you these 9 important advantages:

- Extra flexible for easy coiling and uncoiling
- Bright red for added visibility
- Tough Hazaprene insulation and sheath for rugged service
- Highly flame-resistant in accordance with requirements of U.S. Bureau of Mines and Pennsylvania Dept. of Mines
- Parallel conductors to reduce conductor resistance and prevent kinking
- Insulation grooved for easy separation at connections
- No fibrous fillers to absorb and retain moisture
- Uniform insulating wall prevents shorting between conductors
- Insulation is free-stripping for clean, easy splicing

*Patent Applied For

Examine Hazard Redshot Type RG Shot Firing Cord ... mail the coupon for your free sample. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZARD INSULATED WIRE WORKS
Wilkes-Barre, Pa.

Gentlemen:

Please send me a free sample of the new Hazard Redshot Type RG Shot Firing Cord.

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HAZARD

GM DIESEL
CASE HISTORY No. 526-25

USER: Aurora Limestone Products Co., Aurora, Iowa, producers of road stone and agricultural lime.

INSTALLATION: GM 3-71 Diesel powers a ¾ yd. Unit shovel, replacing a ¾ yd. shovel powered by a gasoline engine.

PERFORMANCE: GM Diesel powered shovel works faster, feeding crusher about 17% more per day. Fuel consumption averages 4 gallons per hour, saving 33% on operating costs.

THIS DIESEL LOADS FASTER

GM
GENERAL MOTORS
DIESEL POWER

FUMEALL

superior filter fabric

INCREASES THE LIFE OF SMELTER BAGS

FUMEALL filter fabric is saving money for many of the world's largest smelters. Actual operational studies show that **FUMEALL** which costs but little more than any other good all-wool filter fabric, lasts up to four times as long.

FUMEALL a combination of virgin wool and Dynel, combines the undisputedly superior filtering qualities of wool with the strength, heat, acid, alkali and moisture-resistance of synthetic fibers.

FUMEALL is available in the exact porosity and weave which meet your specific requirements.... **FUMEALL** can be ordered as yardage or can be fabricated into bags of any size and specification.

Please write for additional details and samples of **FUMEALL** *filter fabric for fume, dust or liquid filtration.*

INDUSTRIAL FABRICS DIVISION

Portland Woolen Mills, Inc.

P.O. Box 2620 • Portland 3, Oregon, U.S.A.

COMPARE St. Paul Added Values!

New heavy-duty St. Paul dump body teams with powerful 2L24 twin hoist to deliver "bonus payloads" for Grasso Construction Co., Beacon Falls, N.Y.

New

Up to 22% more payload capacity per dollar!

15 to 50% lower mounting costs!

Up to 300 lbs. less dead weight per unit!

Class	Model	Wt. lbs.	Payload tons rating at body lengths shown								
			7'	8'	9'	10'	11'	12'	13'	14'	15'	16'
Standard Duty 4 new models	D-16	550	7½	6								
	H-16	650		9								
	H-18	735			9	8	7					
	H-20	795			11½	10	9	8				
Heavy Duty 5 new models	L-20	870			14	12½	11	10	9			
	L-24	1020				15	13½	12	11	10		
	2H20	1370				20	18	16	14½	13	11½	
	2L20	1555				25	22	20	18	16½	15	13½
	2L24	1695				31	28	25	23	21	19	17

Note: 6 new conversion hoists for platforms also available.

Tear out this ad . . . use it to compare St. Paul's new "bonus capacities" with any other hoist on the market. You'll find St. Paul gives you *far more payload capacity per dollar of cost — at all body lengths!*

You'll also get more miles of smooth, trouble-free service — thanks to St. Paul's exclusive new uni-flex sub-frame, with full-floating tension rods, equi-lift strut arms and improved friction-free hydraulic system. See these great new 6 to 31-ton capacity St. Paul hoists and dump bodies at your St. Paul Distributor today — or mail coupon below for free literature.

St. Paul HYDRAULIC

ST. PAUL HYDRAULIC HOIST
Customer Service Department
36121 Main St., WAYNE, MICH.
Send free booklet describing new St. Paul hoists and bodies.

Name_____
Position_____
Company_____
Address_____
City_____ State_____

S-HBC-4

ORE
TRAVELS FIRST CLASS

Here is a unique Belt Conveyor installation using Jeffrey Idlers and allied machinery throughout.

This unit is a 30" wide Belt Conveyor operated at a speed of 350 feet per minute—350 tons of ore per hour, weighing 120 pounds per cu. ft. The conveyor is 1814-foot centers and has a rise of 106 feet in total length. It is driven by a 100 H.P. motor.

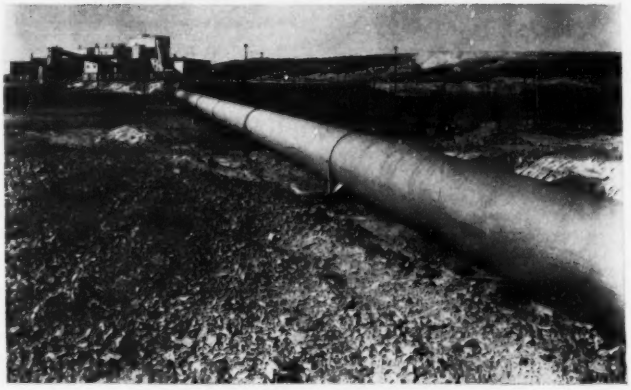
Housed in an 8-foot diameter steel pipe, the conveyor is protected in both cold and hot weather.

Provision has been made for steam pipes to be used in winter—painted aluminum inside and out to reflect heat in summer.

Jeffrey engineers are available to help you determine the conveyor layout that will best meet your requirements both as to capacity and cost of operation.

●

Belt Stackers • Bucket Elevators • Coolers • Conveyors (apron, belt, chain, screw) • Car Pullers • Chains • Crushers • Dryers • Feeders • Grizzlies • Idlers (belt) • Pulverizers • Magnet Separators • Transmission Machinery



THE JEFFREY MANUFACTURING COMPANY
974 North Fourth St., Columbus 16, Ohio
Established 1877

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Jeffrey Mfg. Co. Ltd., Montreal, Canada
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The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain) Ltd., Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio

EVERY MAJOR ASBESTOS FIBER PRODUCER in North America uses dustube® collectors

photo courtesy
Bell Asbestos Mines, Ltd.

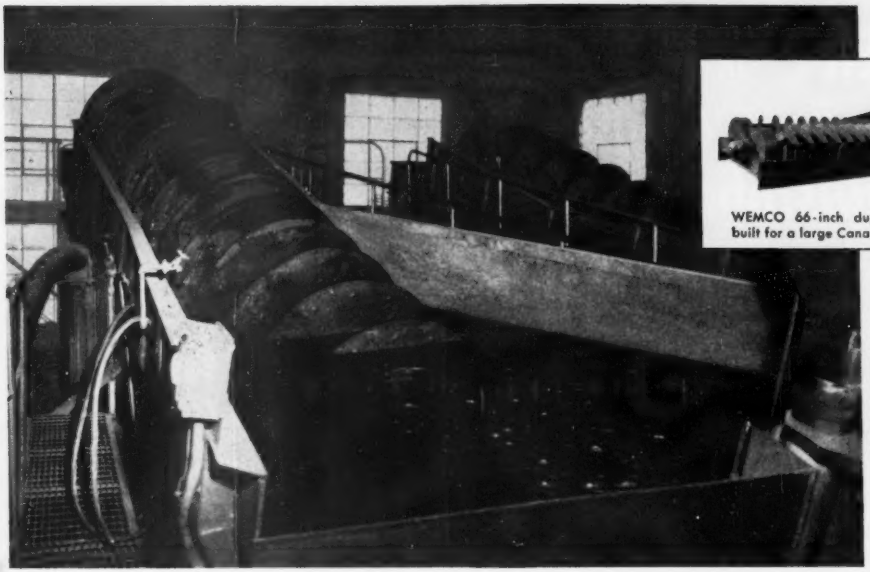
Industry-wide acceptance of a dust collector doesn't just happen—especially so in the asbestos fiber producing industry for controlling its difficult dust problems. Dustube Collectors—the 100% choice of this industry—attained this superiority as a result of its high collecting efficiency, rugged dependable service and low cost operation. Every job was engineered for the application. Dustube engineers, with their many years of practical mining background, cooperated with the mills' engineers to arrive at the most efficient and economical equipment. The extreme flexibility of the Dustube Collector permitted its installation in existing dust sheds or plant facilities. Maintenance costs have been negligible—in fact at one mill tube replacement has averaged only 2% per year!

what the DUSTUBE COLLECTOR can do for you

Many hitherto "impossible" dust conditions in the mining and metallurgical industry have been controlled with virtually 100% efficiency. Dustube engineers will be glad to show you how your dust and fume problems can be handled with equal efficiency. *Write today for Catalog 72-B.*

American WHEELABRATOR & EQUIPMENT CORP.
438 S. Byrkit St., Mishawaka Ind.

dustube® COLLECTORS



WEMCO 66-inch duplex classifier built for a large Canadian operator.

Two 60-inch, series 150 WEMCO S-H Classifiers in the regrind circuit of a large lead-zinc concentrator.

for better Classifier performance

in terms of

- *Less Oversize in Overflow*
- *Less Undersize in Sands*
- *Lower Operating Costs*
- *Longer Continuous Operation*
- *Greater Capacities*

—use ***WEMCO*** *S-H Classifiers*

These Exclusive Mechanical Features *of WEMCO S-H Classifiers are among the important reasons why* ***only*** *the WEMCO unit gives you these better performance factors — with the result that more and more operators throughout the world are choosing WEMCO for their classification jobs.*

1. **40% greater shaft strength,** for protection against shutdowns, is provided by WEMCO's large diameter tubular shafting.
2. **Longer-life wearing shoes** of tough, thick alloy and large cross-section, short cast steel flight arms. Shoe replacement costs have been reported as low as 4/100 of 1 cent per ton.
3. **Foolproof, efficient bearing units** are of the anti-friction type. Lower unit is grit-proof; upper unit is gudgeon type mounted on hub of bevel gear, designed for extra long life.
4. **Simple, hydraulic lifting device** gives uniform action and complete protection from clogging or jamming.
5. **Smooth, efficient drive** uses standard speed motors and a new type cone gear reducer for maximum efficiency of power transmission.

Consult with WEMCO today on your classification problems. Competent engineering of your inquiry will be handled promptly and places you under no obligation.

WEMCO
WESTERN MACHINERY COMPANY
760-766 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

Mobil-Mills · Coal Spirals · HMS Thickeners · HMS Pumps · Sand Pumps · Cone Separators · Drum Separators · Fagergren Laboratory Units · Agitators · Fagergren & Steffensen Flotation Machines · Hydroseparators · S-H Classifiers · HMS Laboratory Units · Dewatering Spirals · Thickeners · Conditioners · Densifiers · Attrition Machines

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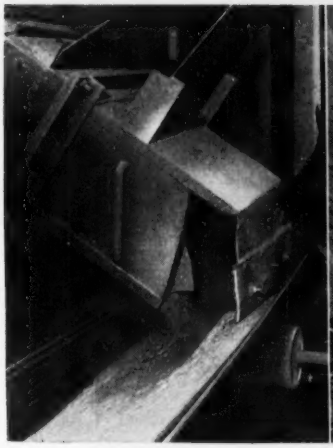
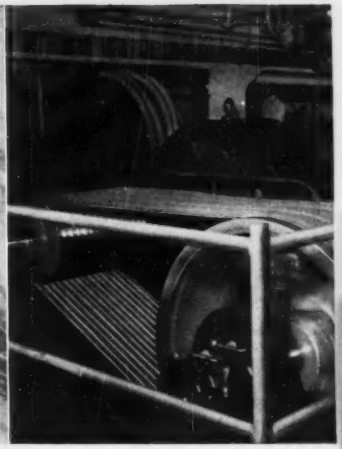
Thermoid
Industrial Rubber Products
Quality Service

You get that extra margin of endurance with

Thermoid

CONVEYOR BELTS • HOSE • MULTI V-BELTS





Whatever your business, you have applications that involve Conveyor Belts, Hose or V-Belts where these Thermoid products will do your job better—provide that extra margin of endurance that cuts costs.

Constant improvement and expansion of engineering and production facilities have always been part of Thermoid's program for the past 70 years. The results of this continuous program are rubber products that guarantee you high operating efficiency and superior performance . . . meet the demand for maximum service at minimum cost . . . last longer and require less maintenance.

When you have a design, production or operating application involving Conveyor Belts, Hose or Multi V-Belts, call your Thermoid distributor. In most cases, he can select the size and type that will serve your needs most efficiently. Thermoid Sales Engineers are always ready to help you with special problems.

It will pay you to specify Thermoid.

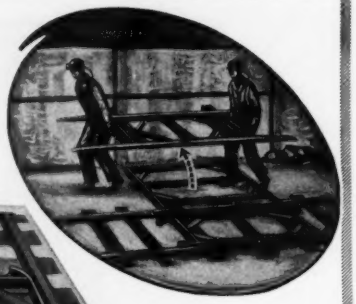
Conveyor & Elevator Belting • Transmission Belting
F.H.P. & Multiple V-Belts • Wrapped & Molded Hose

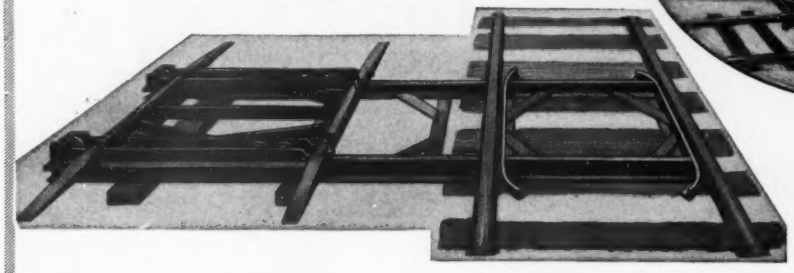
Thermoid

Rubber Sheet Packings • Molded Products
Industrial Brake Linings and Friction Materials

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

Save Miles of Tunneling with the "Canton Car Transfer." Loads entire train of empties on a single track





MOVED TO NEW LOCATION IN MINUTES.

No need to dig and take out twice the width of a tunnel when a single track will do the job more economically . . . The "Canton" loads entire train on the single track. This famous economy device can be installed on any track or gauge and rail now in use. Its operation is simplicity itself . . . pushing empty car on track by locomotive then moved by hand to transfer section, permitting locomotive and cars to pass. Train is pulled out all at one time. Two men in two minutes can take down, to move the three units to new location when desired . . . no alterations required for track or rails. Timken Roller Bearings enable easy shunting of heavy cars to maximum weight of six tons. The Car Transfer speeds up loading, hauling, saves expensive double-tracking. Write for complete literature; please use street and zone numbers.

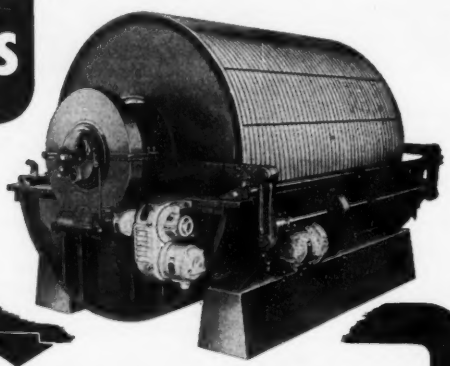
American Mine Door Co.

2039 Dueber Avenue
Canton 6, Ohio

Manufacturers of "Dustributors" • Automatic Switch Throwers • Automatic Mine Doors • Mechanical Track Cleaners

MORSE CONTINUOUS VACUUM FILTERS

PARAMOUNT IN EFFICIENCY AND MECHANICAL DEPENDABILITY



Dependable for Continuous Duty—Fully Automatic. Morse Drum and Disc Filters are highly regarded for satisfactory performance and low maintenance—made in a wide range of sizes to meet most all requirements.

MORSE DISC FILTERS are ideal for filtering more than one character of concentrate or material where separated filtrates are desired.

Write for Bulletin No. 4710

MORSE BROS. MACHINERY COMPANY

ESTABLISHED 1898 DENVER, COLORADO, U. S. A. (CABLE MORSE)

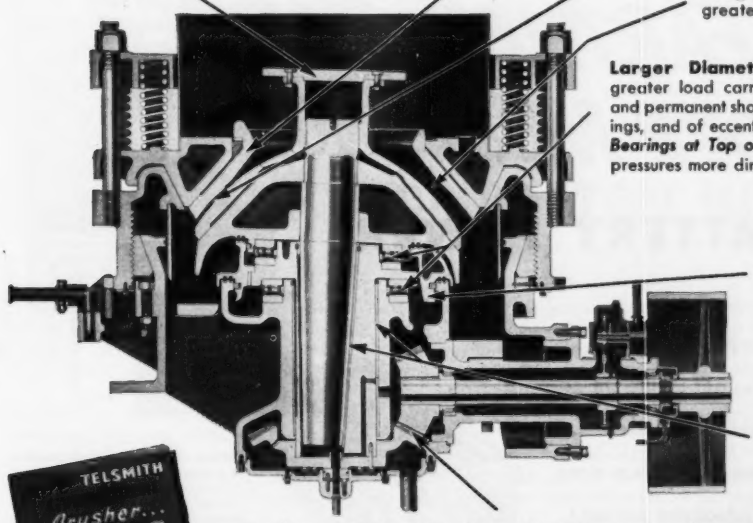
Outstanding FEATURES OF THE TELSMITH *Gyrasphere*®

Feed Distributor gives an even distribution of the feed around the entire feed opening, resulting in a more uniform crushed product.

Gun-Lock for Holding Concave Ring — Automatic self-tightening, requires no bolts, and is easier to change.

Longer Parallel Crushing Zone gives a finer, more uniform product with a larger percentage down to size.

Longer Crushing Stroke gives greater capacity and less packing.



Larger Diameter Roller Bearings with greater load carrying capacity. Give perfect and permanent shaft alignment in eccentric bearings, and of eccentric in main frame. ***Both Roller Bearings at Top of Eccentric*** carry all crushing pressures more directly into heavy main frame.

Patented Rotary Seal with piston ring and labyrinth seals, gives most perfect protection against entrance of dust or water, or loss of lubricant.

Higher Eccentric Bearings give more bearing area in the upper zone of greatest crushing pressures, assuring more permanent shaft and eccentric alignment and longer bearing life.

Send for Bulletin No. 274

Main Drive Gear At Bottom of Eccentric assures more perfect and permanent alignment of gear and pinion, giving smoother running and longer life for both gear and pinion and less strain on countershaft bearings.

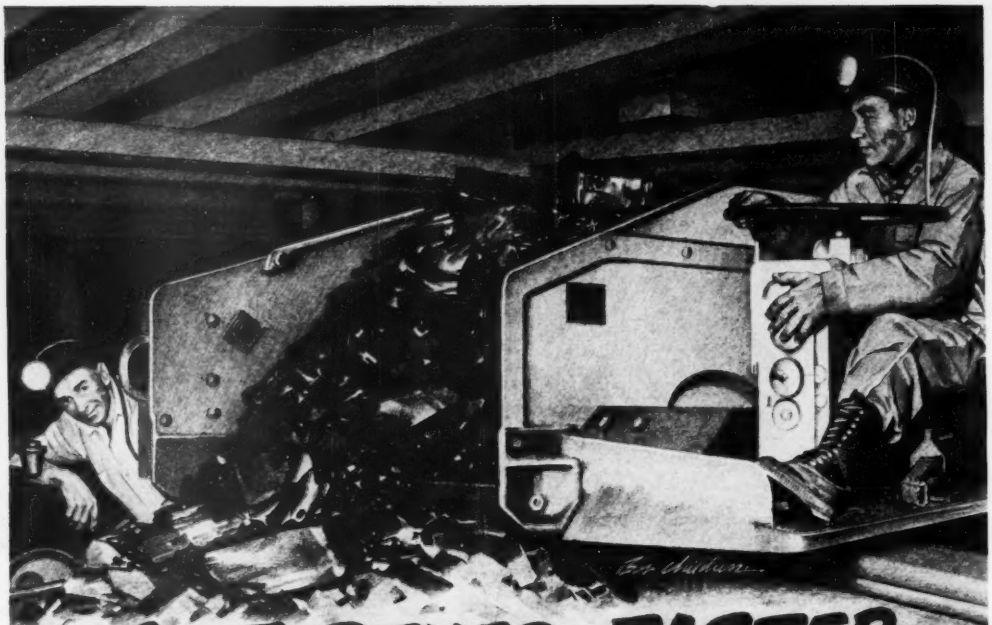
Y-12

STYLE FC
FINE CRUSHING

SMITH ENGINEERING WORKS, 502 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

Samuel Osborn (S. A.) Ltd., Johannesburg, So. Africa • Armco International Corp., Buenos Aires, Argentina
51 East 42nd St., New York 17, N. Y. — 211 W. Wacker Dr., Chicago 6, Ill. — Mine & Smelter Supply Co., Denver 17, Colo. — Mines Eng. & Eqpt. Co., San Francisco 4, Calif.
Ontario Eqpt. & Supply Ltd., Toronto, Canada • Mussens Canada Ltd., Montreal, P.Q. • Gordon Russell, Ltd., Vancouver, B. C.



GO FARTHER, FASTER MOVE MORE COAL

WITH BATTERY POWER

In many mines, battery-powered shuttle cars give more ton-miles per shuttle car-hour . . . travel faster . . . discharge faster . . . travel greater distances . . . produce more tons per man-shift . . . reduce cost per ton! All this in addition to safety unequalled with any other type of power!

Battery car users—you may be able to increase battery service as much as 50% with the Gould Plus-Performance Plan. Write Gould Battery Information Headquarters for details.

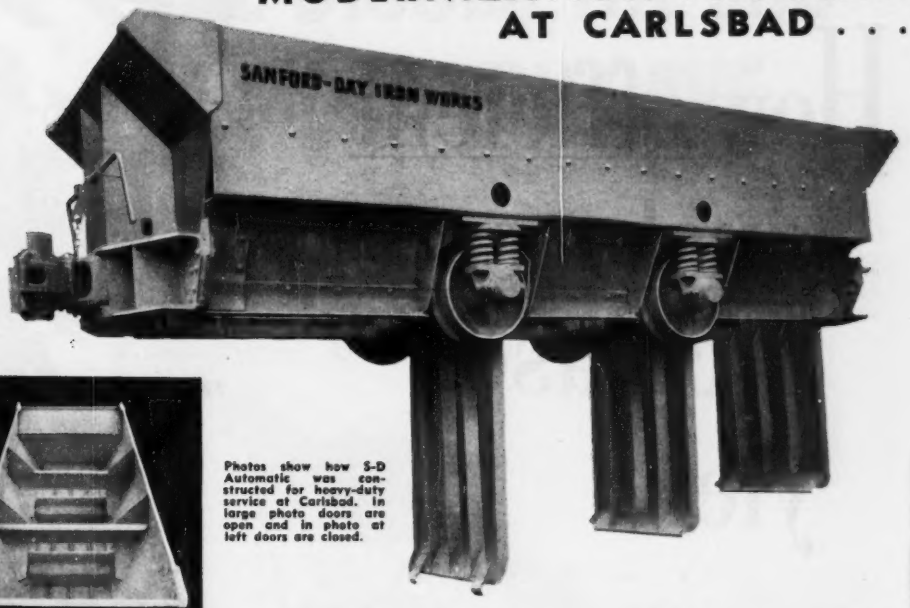
The Gould "Thirty"
America's Finest
Mine Shuttle Car Battery

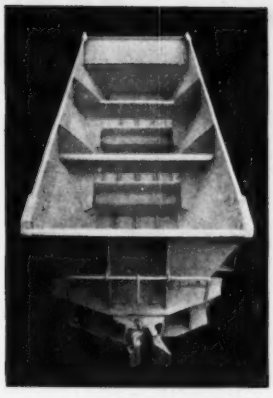
GOULD *Industrial Batteries*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

UNITED STATES POTASH CO. CONTINUES MODERNIZATION PROGRAM AT CARLSBAD . . .





Photos show how S-D Automatic was constructed for heavy-duty service at Carlsbad. In large photo doors are open and in photo at left doors are closed.

INSTALLS S-D AUTOMATIC DROP BOTTOM MINE CARS

The most recent development in the U. S. Potash modernization program at Carlsbad, New Mexico is the installation of 25 S-D Automatic Cars.

The S-D Automatic Drop Bottom Cars will haul potash non-stop because trips dump-on-the-move. A tripping device mounted between rails automatically opens the doors as each car moves over opening between rails at the Surge Bin. After dumping load and as each car moves out of the bin, a closing device automatically locks doors shut. Expensive dumping equipment and dumping labor are both eliminated.

The capacity of each car is between 8 to 10 tons. Each is approximately 16½ feet long by 5½ feet wide by 48 inches high. All cars are sealed against dust leakage and operate on a 42 inch track gauge. These cars are built of ½ inch steel for heavy-duty performance.

But this page isn't big enough for the whole story. We point out this Carlsbad installation as evidence that heavy-duty S-D Automatics offer the most practical and most economical method of haulage for many metal and non-metallic mines. At the same time, you will not want to overlook the fact that in your particular operation our S-D Rocker-Type Side Dump Cars or our S-D Rotary Cars may be the logical answer to lower costs. Certainly, our more than 50 years of experience in building mine cars exclusively for almost every conceivable operation places us in an excellent position to build the exact car needed for your operation.

Our engineers are available at any time to assist you in adapting the S-D Automatic Car to your operation. Sanford-Day Iron Works, Knoxville, Tenn.

After 50 years of leadership in the industry, Sanford-Day still devotes its entire capacity to the production of mine cars. Most of the improvements in mine car design and construction originate with this company.

SANFORD-DAY IRON WORKS

Your Management wants to know...

How efficient dust recovery increases yield

. . . .

In every industry, from ore to fabric to steel, Buell engineers, working with plant engineers, have established an enviable 18-year record of turning unnecessary dust losses into substantial new profits. What's more, a Buell Dust Recovery System uncovers these additional important advantages: improved product quality, smoother plant-community relations and higher employee morale.

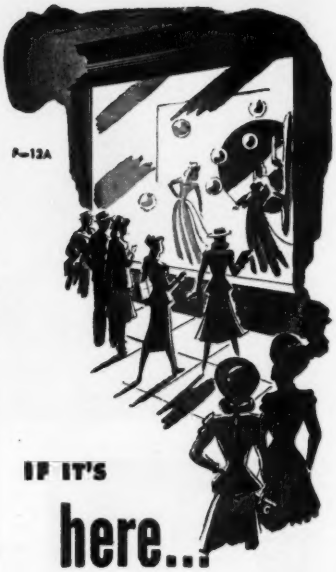
To take advantage of Buell's background and experience in the highly specialized science of Dust Recovery, ask for further information about Buell's **3 basic systems** of dust collection. See how they can help you turn dust into dollars. Send for Buell's new, informative bulletin titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 19-J, 70 Pine Street, New York 5, New York.

Van Tongeren Cyclone | 'SF' Electric Precipitator | Precipitator-Cyclone Combination | Type 'LR' Collector | Dust Hopper Valves

buell

ELECTRIC CYCLONIC

ENGINEERED EFFICIENCY IN DUST RECOVERY



IF IT'S here...

IT'S news...

IT'S WORTH STOPPING TO SEE!

Maybe Industry doesn't maintain show windows on Fifth Avenue or State Street or Wilshire Boulevard like America's great department stores. But your industry has a mighty effective show window... *and this is it*... this magazine. In these advertising pages alert manufacturers show their wares. Here you will find up-to-the-minute news about products and services designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in *your* business, *your* industry... and to stay well-informed... *read all the ads too.*

McGRAW-HILL PUBLICATIONS

THE BIGGER THE JOB THE MORE YOU SAVE

BARBER-GREENE

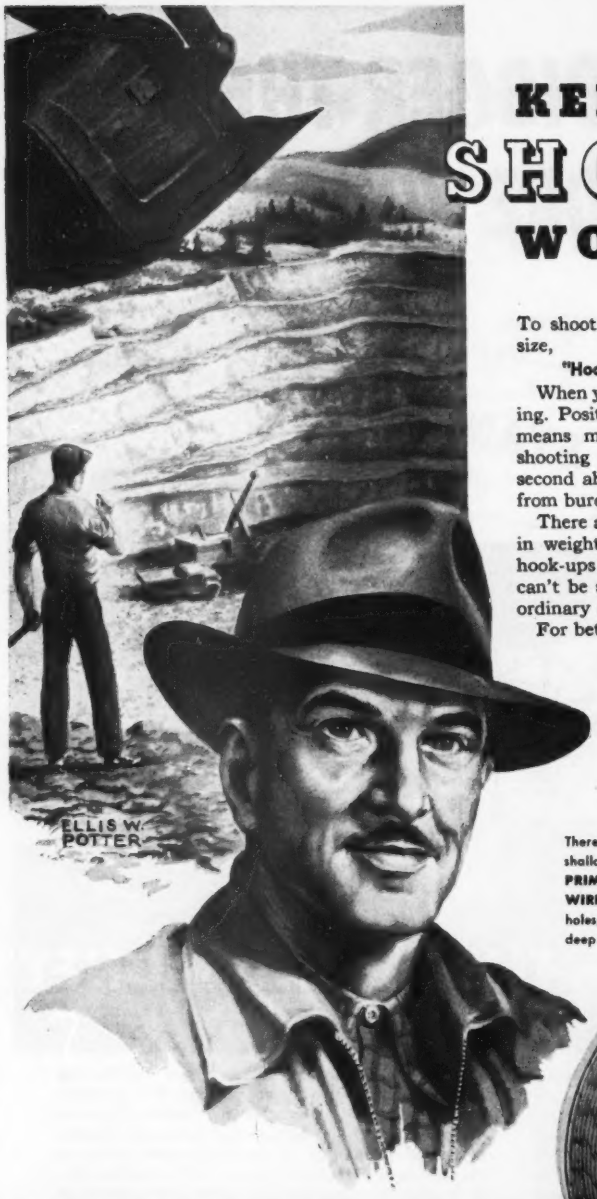
MODEL 76 PERMANENT BELT CONVEYORS

SAVE SELECTION ENGINEERING ERECTION **TIME ... AND MONEY**

Barber-Greene Conveyors are made of pre-engineered, self-contained, *standardized* units that are quickly assembled without costly engineering time. Field assembly of miscellaneous pulleys, bearings and dozens of other parts is completely eliminated. B-G Conveyors are as easily disassembled, expanded or relocated—with 100% salvage. The value of these B-G features is in direct proportion to the size and scope of the conveying job. The bigger the job—the more you will save. Wherever you have bulk handling problems—or are planning to modernize or expand present facilities—investigate Barber-Greene Conveyors. Take advantage of Barber-Greene's extensive experience in solving problems of bulk handling similar to your own. Complete descriptive data is available for handy reference—it's yours for the asking.

Barber-Greene BG

Aurora, Illinois, U. S. A.



KEEPS SHOVELS WORKING

To shoot that heavy overburden down to handling size,

"Hook Up and Detonate with PRIMACORD"

When you use Primacord you get faster, easier loading. Positive firing of every cartridge in every hole means more work from your explosives. Planned shooting detonates the front holes a fraction of a second ahead of those behind, thus giving you relief from burden and better fragmentation.

There are other advantages, too. Primacord is light in weight — saving you time in making trunk line hook-ups and down-the-hole branches. And it's safe — can't be set off by stray currents, friction, sparks or ordinary shocks.

For better digging, use PRIMACORD regularly.

Ask your explosives supplier or write us direct for further facts

THE ENSIGN-BICKFORD COMPANY
SIMSBURY, CONNECTICUT
Also Safety Fuse since 1836

There's a type for every job. **PLAIN PRIMACORD** for shallow holes and surface trunk lines; **REINFORCED PRIMACORD** for deep holes and resistance to abrasion; **WIRE COUNTERED PRIMACORD** for deep, ragged holes; and **PLASTIC REINFORCED PRIMACORD** for deep holes and unusual wet conditions.

Use PRIMACORD®

The PROVED and APPROVED DETONATING FUSE

DOUBLE BARREL Advertising

Advertising men agree—to do a complete advertising job you need the double effect of both Display Advertising and Direct Mail.

Display Advertising keeps your name before the public and builds prestige.

Direct Mail supplements your Display Advertising. It pin-points your message right to the executive you want to reach—the person who buys or influences the purchases.

More and more companies are constantly increasing their use of Direct Mail because it does a job that no other form of advertising will do.

McGraw-Hill has a special Direct Mail Service that permits the use of McGraw-Hill lists for mailings. Our names give complete coverage in all the industries served by McGraw-Hill publications—gives your message the undivided personal attention of the top-notch executives in the industrial firms. They put you in direct touch with the men who make policy decisions.

In view of present day difficulties in maintaining your own mailing lists, our efficient personalized service is particularly important in securing the comprehensive market coverage you need and want.

Ask for more detailed information today. You'll be surprised at the low over-all cost and the tested effectiveness of these hand-picked selections.

McGRAW-HILL
PUBLISHING CO., INC.
330 West 42nd Street
NEW YORK 18, N. Y.

Your *SAFEST* buy in wire rope blocks

Load-Rated!

Here's a common-sense way to avoid the risk of accidents. American CROSBY Blocks are LOAD-RATED . . . safe working capacity permanently embossed in the side plate . . . so your men can *know* what load the block will carry.

PACKAGED

Your load-rated CROSBY blocks come in individual, factory-sealed cartons. Easy to buy, easy to stock and handle; delivered to the job in perfect working order. Sold by leading distributors everywhere.

American CROSBY

Load-Rated Wire Rope Blocks

Made by the makers of genuine Crosby Clips:

AMERICAN HOIST & DERRICK CO., ST. PAUL 1, MINNESOTA

SMALL HOLES SAFER SUPPORTS

thanks to

INTRA-SET!

Drill rock bolt holes you can trust. Use the popular 4-point, 1¼" gage Intra-Set carbide-tipped drill steel. Intra-Set's small holes assure better bolt anchorage; safer, more secure supports. Carbides speed drilling, stay sharp and on the job longer. The 4-point bit affords easier starting, following and loading. Write, Rock Bit Sales & Service Co., 2514 E. Cumberland St., Philadelphia 25, Pa.; 350 Depot St., Asheville, N. C.

◀ Intra-Set: Chisel or 4-point—gage sizes, 1⅛" to 2¼"

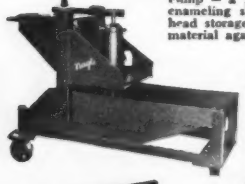
Carbide Rok-Bits: Chisel or 4-point—gage sizes, 1⅛" to 4" ▼

ROCKBIT
SALES AND SERVICE CO.

CARBIDE ROK-BITS • INTRA-SET ALLOY DRILL STEEL • LONG HOLE DRILLING TOOLS • HOLE-SAVERS • ALL TYPES OF HOLLOW DRILL STEEL

NAGLE HAS SOLVED MANY "TRICKY" PUMPING PROBLEMS

The material that was "too hot to handle," the gritty, corrosive slurry that "no pump could stand up under," THOSE are the jobs that went to Nagle Pumps—the kind of jobs for which they're built! Nagle has available the liquid-contact material best suited to your problem. Nagle Pumps are designed throughout for ease of maintenance. Horizontal and vertical shaft types. IF IT WILL FLOW A NAGLE WILL PUMP IT.



LEFT: Nagle portable Combination Sump and Pump — a 1½" type SW-OB handles porcelain enameling slips and glazes from mills to overhead storage — 33 g.p.m. of 1.9 specific gravity material against 50' head.

RIGHT: Nagle 2" type SW-OB, frame 93 J Hastalloy pump mounted in a Hastalloy vessel, handles sulphuric acid saturated with chlorine from a low pressure reactor. This single stage inverted entrance pump is for wet pit submerged operation. Has dual radial bearings and balanced shaft.

NAGLE PUMPS

NAGLE PUMPS, INC.

1239 CENTER AVENUE, CHICAGO HEIGHTS, ILLINOIS

PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

QUICK SOLUTION to MANPOWER PROBLEMS

through the SEARCHLIGHT SECTION of this publication. The market place for those offering or wanting the services of technical and specialized executives, the SEARCHLIGHT SECTION offers a quick, effective solution to your manpower problems. Because its readership is confined to just the type of men you need, waste circulation is avoided—you reach only the men you want.

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Classified Advertising Division

ENGINEERING & MINING JOURNAL

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New York 36, N. Y.

on the world's
BIGGEST
wire rope jobs...

experienced riggers demand
GENUINE
CROSBY CLIPS

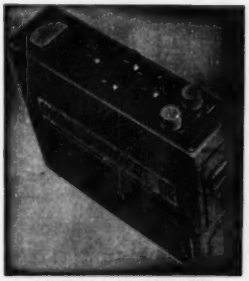
Drop-forged, hot-dip galvanized wire rope fasteners
•
SIZES FOR ALL WIRE ROPE
•
DISTRIBUTORS EVERYWHERE

AMERICAN HOIST & DERRICK CO.
ST. PAUL 1, MINNESOTA

CAN YOU AFFORD TO BE WITHOUT THE

Scintillometer

LOCATE URANIUM 100 TIMES EASIER. THE ONLY PORTABLE GAMMA RAY DETECTOR EMPLOYING CRYSTAL SCINTILLATION. DETECTS ALMOST 100% OF GAMMA RAYS IN COMPARISON TO LESS THAN 1% DETECTED BY THE GEIGER COUNTER.



PORTABLE OR AIRBORNE
ALL TYPES GEIGER COUNTERS;
SPECIAL LONG PROBE COUNTERS
FOR TESTING DRILL HOLES;
ULTRA VIOLET LIGHTS

Engineers Syndicate, Ltd.

The House of Geiger Counters
5011 Hollywood Blvd.
Hollywood 27, California

Here's a Boom that REACHES for Ex[illegible]bs

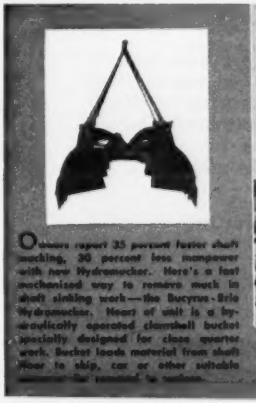
The all-hydraulic Hydrocrane reaches into windows, doors and box cars . . . over fences . . . under beams . . . between wires and beams — without moving crane an inch! Telescoping boom extends and retracts a distance of eight feet.

Telescoping boom plus precision hydraulic control combine to make the Hydrocrane ideal for placing conveyor machinery in shaft cage, unloading freight cars, erecting and dismantling machinery, cleaning up ore spillage under pockets, loading ore into cars, and handling mine timbers. Special hydraulic grapple picks up and sets down timbers without assistance — eliminates need of helper.

Here's a crane that fills the bill on dozens of surface jobs around the mine. It squeezes into close quarters — operates by cushion smooth hydraulic power — is controlled entirely by hand levers, no tricky foot work.

Write now for full details or see your Hydrocrane distributor.

159H52



Owners report 35 percent faster shaft sinking, 30 percent less manpower with new Hydramucker. Here's a fast mechanized way to remove muck in shaft sinking work—the Bucyrus-Erie Hydramucker. Heart of unit is a hydraulically operated clamshell bucket specially designed for close quarter work. Bucket loads material from shaft floor to skip, car or other suitable [illegible]

Every crane function fully hydraulic—boom hoist, load hoist, swing, boom telescope, outrigger set and retract, bucket close.

BUCYRUS-ERIE
HYDROCRANE DIVISION
South Milwaukee, Wisconsin

THIS KUE-KEN PAID FOR ITSELF IN THREE WEEKS!

BALL MILL CAPACITY INCREASED 46%

A Peruvian operator, using a 24" x 12" Blake type crusher requiring 35 H.P., to supply his 6' x 5' Ball Mill with feed, was obtaining a maximum mill capacity of 7.28 tons per hour. A 6" x 12" KUE-KEN crusher requiring only 15 H.P. was then installed to replace the Blake type. Because of the finer feed produced by the KUE-KEN, Ball Mill capacity immediately jumped to 10.71 tons per hour . . . an increase of over 46%! The operator claims that the KUE-KEN actually paid for itself, including transportation and installation, in the first three weeks of operation!

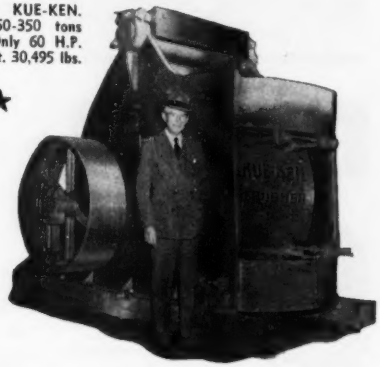
ONLY KUE-KEN crushes with firm direct strokes that practically eliminate jaw plate abrasion. "CRUSHING WITHOUT RUBBING".

ONLY KUE-KEN operates at 375 crushing strokes per minute (compared with 250-300 RPM for other well known makes of crushers), providing far greater capacity, and a finer more uniform product.

ONLY KUE-KEN seals all mechanism against dirt and dust in a "crankcase type" filtered oil bath to permit safe, high-speed long life operation.

42" x 27" KUE-KEN. Capacity 250-350 tons per hour. Only 60 H.P. required. Wt. 30,495 lbs.

★



Learn how you can do any crushing job faster, better and at less cost with a KUE-KEN Balanced Crusher.

★

Write for factual data.

STRAUB MFG. CO.

522 CHESTNUT STREET • OAKLAND 20, CALIF. KUE-KEN Pronounced "QUE-KEN". U.S. and foreign patents pending

Pennsylvania Crusher Co., Exclusive Licensed Eastern Manufacturer and Distributor, Broad and Arch Streets, Philadelphia, Pa.

Sir W. G. Armstrong Whitworth & Co. (Ironfounders) Ltd., Authorized Licensed Manufacturer and Distributor. Close Works, Gateshead-upon-Tyne, England.

KENNAMETAL *Inc.*

BUYS TANTALITE • COLUMBITE (NIOBITE)

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Prompt, businesslike settlement by private tantalite user and dealer secures you the best results. Cash advance against settlements. 50% or higher combined pentoxides (Cb_2O_5 plus Ta_2O_5) purchased. Our superior refining processes enable us to utilize lower grade products and thus to minimize penalties.

Write or cable your offer to:

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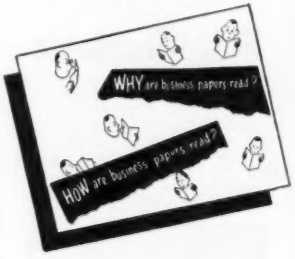
MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES



A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

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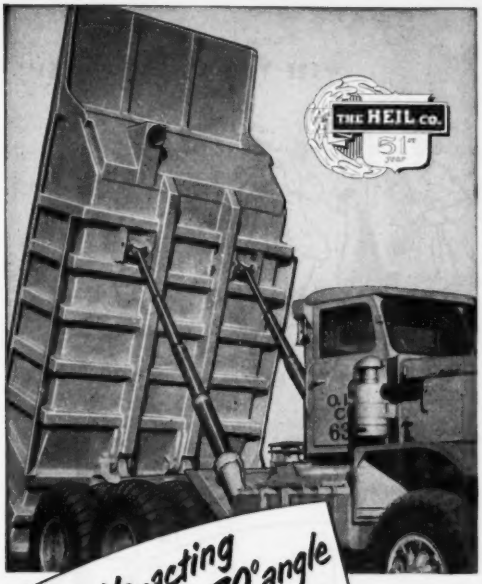

Double-acting power ... 70° angle — for fast, clean dumps of loads up to 50 tons

Exclusive cross-channel body design — to stand up under impact loads of rock and ore

You get both—with
HEIL TELESCOPIC HOISTS
and Rock Bodies

HOIST has built-in snubber to prevent "kickback" or overdumping with sticky load. Universal-joint mounting prevents binding when truck frame twists or flexes. Mounting height as low as 11". Valve handles top pump output with almost no pressure loss. . . . Body has wearplate of ½" high tensile steel, to resist abrasion and local deformation. Cross-channel design prevents body-sag—adapts to exhaust gas-heated floor. . . . These and other Heil advantages mean dependable, trouble-free performance. Have your nearby Heil distributor show you. Or write us for further information.

BH-177

THE HEIL CO.

DEPT. 75102, 3075 W. MONTANA STREET • MILWAUKEE 1, WISCONSIN
Factories: Milwaukee, Wis. — Hillside, N. J.
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You Get
LONG LIFE
from Norton Grinding Wheels

Reduce your grinding costs, get longer wheel life . . . by specifying Norton grinding wheels.

Cool-cutting Norton ALUNDUM* wheels give maximum efficiency in sharpening steel bits. Made from a special aluminum oxide abrasive that is hard and tough, they have just the qualities you want for grinding rock bit steel.

For your carbide tipped bits you'll like Norton green CRYSTOLON* wheels. They are made of a special type of hard, sharp silicon carbide abrasive and an improved vitrified bond. It's a combination that will give you just the right grinding action for sharpening the high cost carbides.

For cutting drill steel, specify Norton ALUNDUM cut-off wheels and Norton cup wheels for dressing or squaring ends of steel after it is cut.

Your Norton Distributor Can Give You Valuable Help

Besides his own practical experience with abrasive applications in the mining field, your Norton Distributor can call in Norton Abrasive Engineers for additional expert aid in solving your grinding problems. Take advantage of the wide store of helpful knowledge he makes available to you. See him for the right wheels to use in *any* grinding job. NORTON COMPANY, Worcester 6, Massachusetts. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

NORTON
ABRASIVES

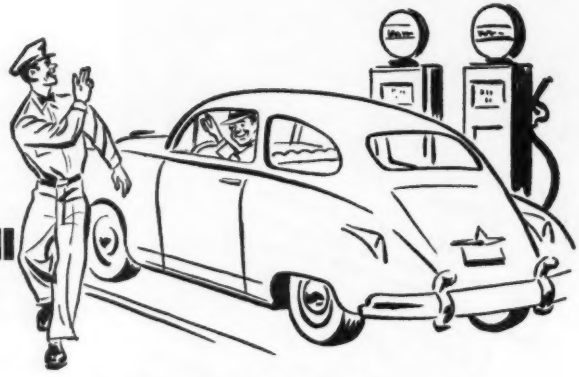
Making better products to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"



Nobody knows for sure how it started—this line about "See you at the Polls!" we're hearing all over these days.

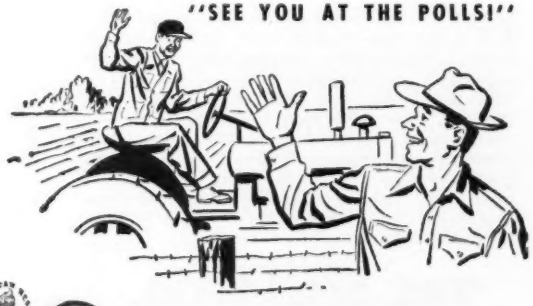
Best explanation seems to be that it came from that state candidate out west. . . . His opponent in a debate got all riled up and challenged him to fight it out in the alley.

But he said—"I'll settle this the AMERICAN way—I'll see you at the polls!" And the audience picked up the chant.

Now everybody's saying it—and on Nov. 4 everybody will be *doing* it!

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"



Engineering and Mining Journal

Here's Why it Pays You to Read the Advertising

The advertising is a rich source of valuable information. In this magazine it offers you ideas and products that may well apply advantageously to your business.

Every issue is a catalog of goods, materials, and services — quickly available to you—just for the reading.

Leaders in business and industry turn to the advertising because they've discovered it helps them run their businesses more profitably.

When you read all the ads in this magazine, the chances are good that you'll get a lead that will materially help you do a better job. For example, you may find a specific piece of equipment that will be a profitable time-saver. Or a tool that will increase worker efficiency. That's why it pays to read the advertising. It's good business.

HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL publications

NO!

Here, conventional U-Bolt clips are properly applied but rope is distorted and subject to life-shortening strains under load.

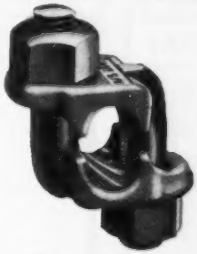
NO!

Inexperienced workmen can easily put conventional U-Bolt clips on incorrectly with saddles not on load-line. Result: Weakened rope — risk of accidents.

It CAN'T Go On Wrong

Both halves of the Laughlin Safety "Fist Grip"* clip are identical. There is no wrong way. The most careless workman can't put 'em on wrong (unless he forgets to tighten the nuts). And they're not only safer and practically foolproof, but they're a darn sight easier to use.

Here's why:



Nuts are out in the open, can be tightened with any wrench, and don't have to be "inched around."

Bolt ends are shorter and don't get battered or bent. Nuts are always easy to remove when clip is to be re-used.

No crushed rope ends, under "Fist-Grips" to cut off. Rope saved.

Fewer clips are required in many installations, so there is less work to do.

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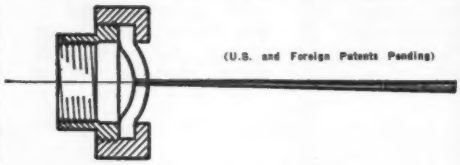

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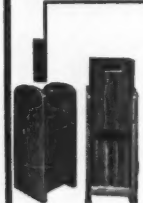

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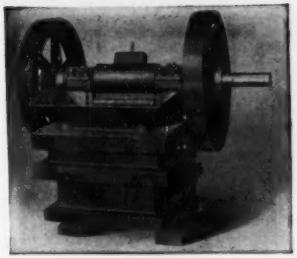

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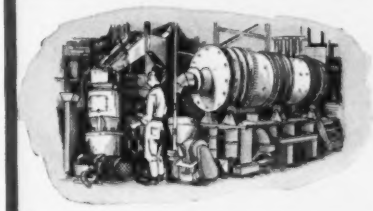
Laboratory Tests Help Quarry Operator Stop Dust Hazard

PROBLEM . . .

Dangerous silica dust was a health hazard to workers in a large eastern crushing plant. Minus 2-in. quartzite was being reduced by crushing and dry grinding to a size suitable for use in silica brick. The dust problem was acute.

WHAT WAS DONE . . .

The problem was brought to the Allis-Chalmers Research Laboratory. A series of batch tests — followed by continuous pilot mill tests — showed that the specified size analysis could be obtained by wet grinding. A flowsheet was worked out in which the quartzite was crushed in a *Hydrocone* crusher, followed by wet grinding the crushed product in rod and ball mills and blending the mill products in the correct proportions.



RESULT . . .

Guided by these laboratory tests, this quarry operator set up a wet process which eliminated a hazardous dusting condition and still obtained the specified product.

A-3834

Hydrocone is an Allis-Chalmers trademark.

ALLIS-CHALMERS Research Laboratories

PILOT PLANT FACILITIES ARE AVAILABLE FOR YOUR USE IN . . .

Grinding
Crushing
Concentration
Food, Chemical and Grain Processing
Oil Extraction
Pyro-Processing

The Laboratory's complete facilities for chemical and physical analysis have also been used profitably by hundreds of clients. All testing services include the technological skill of the Laboratory's personnel, who are guided by Allis-Chalmers invaluable experience in engineering equipment for industry.

Testing is done on a confidential basis. Charges are based on costs. Estimates for test work can be obtained from the A-C representative in your area or by writing Allis-Chalmers Research Laboratories, Milwaukee 1, Wis.

ALLIS-CHALMERS

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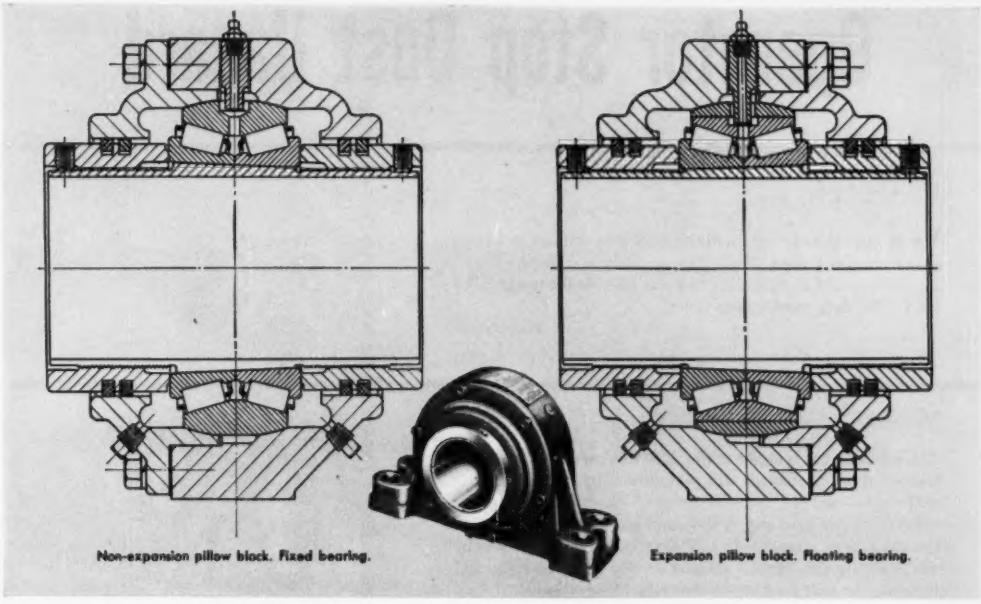
Send for Laboratory Bulletin 07B6419A

NEW TIMKEN® BEARING PILLOW BLOCK



First application of new tapered bore TIMKEN® bearing makes new Dodge-Timken pillow block more compact

IT takes up less space. It weighs less. Yet the new Dodge-Timken® All-Steel pillow block has tremendous load-carrying capacity.

It's the result of the combined achievements of the Dodge Manufacturing Corporation, Mishawaka, Indiana, and The Timken Roller Bearing Company and makes use of an entirely new Timken bearing. Never before has a self-aligning, non-adjustable tapered roller bearing with tapered bore been used in pillow blocks.

Being of all-steel construction, this new Dodge-Timken pillow block is more compact and fills a real need where space is a factor. It is available in both expansion and non-expansion designs. And it incorporates all the advantages of Timken tapered roller bearings.

Because of their tapered construction, Timken bearings take radial and thrust loads in any combination. Line contact between rollers and races gives Timken bearings load-carrying capacity to spare. Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel—and under normal conditions will last the life of the machinery with which the pillow blocks are used.

When you install new Dodge-Timken pillow blocks, you can expect dependable performance because the bearings are the best. No other bearing can give you all the advantages you get with Timken bearings. Specify them for all your other machinery, too. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST →▯← LOADS OR ANY COMBINATION